Development of the next-generation University of Wyoming King Air (UWKA-2) research aircraft continues as we are now 2.5 years into this project. In summer 2020, the University purchased a lightly used, King Air 350i aircraft (s/n Fl-862). Since that time, nearly every aspect of that original aircraft has been modified; including new, bigger engines, heavy-weight landing gear, more powerful electrical generators, and updated avionics. In addition, more than 50 research-specific modifications have been designed and completed. Some of these include an extended nose and nose-boom, underwing pylons for instrument mounting, two large nadir ports for radar and lidar and two large upper ports for radar, several smaller upper ports for aerosol and trace gas inlets, and belly hardpoints for installation of larger instrument under the fuselage.

Earlier this fall, a major milestone was reached as all of the major modifications to the airframe were completed. The aircraft is now going through FAA flight testing for certification (see above image with the aircraft fitted with test shapes for flight tests). When completed, the new aircraft will be dual-certificated; able to operate in Commuter category when ferrying to and from project locations and operating Restricted category when instruments are installed it is conducting research. Flight testing is schedule to be complete in early 2024 after which the aircraft will go to the paint shop before the final delivery to UW, expected in March of 2024.

Once the aircraft arrives in Laramie, attention will turn towards installing and testing research equipment. This period of testing will continue through 2024 and into 2025, as we bring both existing and new capabilities online. The aircraft has already been allocated for a project to be flown based out of Salt Lake City in summer 2025; and several other projects remain under consideration by the National Science Foundation for possible deployments in 2025 and 2026.

The new aircraft is essential to the strategic vision of the Department of Atmospheric Science to retain national prominence in airborne atmospheric observations, an expertise that uniquely defines us. It will enable research in areas such as air quality, fugitive emissions, wildfires, severe storms, winter weather and cloud processes affecting water availability.

For more information and updates visit: www.uwyo.edu/atsc
Greetings and welcome to another addition of the Laramie High Tidings, the annual newsletter from the University of Wyoming Department of Atmospheric Science. This past year included many changes in the department including the addition of two new tenure-track faculty along with several new research scientists, engineers, and technicians. The department is now home to 26 full-time staff with three more hires expected in early 2024. We also have 3 full-time post-docs and anticipate hiring 3 to 4 more by summer of 2024. The department is as big as it ever has been and we continue to expand. This is all very exciting for our future, although finding space is becoming difficult!

Elk Mountain Observatory sits at 10,861 ft in the north-west of Laramie. Clouds and high wind speeds result in strong vertical gradients of cloud droplets and ice crystals at the mountain-atmosphere interface and the peak is immersed in clouds frequently during the winter. EMO was established in the early 1960s primarily for cloud seeding and related cloud-aerosol process studies. Funding to develop much of the site was provided through Project Skywater at the Bureau of Reclamation. From 1960-1980 EMO was key to ATSC’s research on ice particle nucleation and growth, chemical processes between aerosols and clouds, and atmospheric aerosol characterizations. ATSC maintained an active research program utilizing EMO until the early/mid-2000’s. The last large scale research campaign was EMLACE (Elk Mountain Laramie Area Closure Experiment) in 2004 and the last instruments (meteorological and particulate matter) were removed for roof work about 2018. Since the mid-2000’s very little research has been conducted utilizing EMO. EMO has largely lain fallow since the mid 2000s, but new interest has been sparked across the university. In September, 2023

Over the last couple of editions of this newsletter, you may recall reading about University plans for merging the departments of Atmospheric Science and Physics and Astronomy. Earlier this year, the University decided to abandon plans for that merger allowing us to re-focus our attention on developing the future of our department. As you will read about in this issue, the development of the next generation University of Wyoming King Air (UWKA) research aircraft is nearing completion. We anticipate welcoming the new aircraft with a ground-breaking celebration sometime in spring 2024. Also, several new project efforts were awarded/launched to department faculty. Three of those projects are highlighted in this newsletter that include significant funding from three major national agencies: NASA, DOE, and NSF.

This newsletter will reach you during the annual American Geophysical Union (AGU) annual meeting in San Francisco. ATSC will have a large presence at this year’s meeting with four of seven faculty and several students attending and presenting. We will also host a booth (partnered together with UW Department of Geology/Geophysics) for recruiting potential graduate students and also meeting with friends and alumni of the department. If you are at AGU, plan to stop by. If you miss us at AGU, we will also have a presence at the American Meteorological Society (AMS) annual meeting in Baltimore in early 2024. A similar booth will be setup during the AMS career fair on Sunday evening, and if you’re around please swing by, say hi, and meet some of our faculty and current students.

We had a special treat earlier this fall as alum Dr. Russ Schnell stopped into the department for a visit. Dr. Schnell holds the distinctive honor of being the first person awarded a degree (both M.Sc. and Ph.D.) from the department. Russ spent his lunch visiting with our current graduate students and inspired them with stories of his many great achievements over his illustrious career with NOAA and the UN.

Following lunch, Russ presented a seminar discussing the changing atmosphere and the challenges that we all face in addressing those changes. I would also like to thank Russ for his wonderful support over many years. Russ and his wife continue to support the department through monetary contributions that allow us to offer quality educational opportunities to our students.

Lastly, I want to give a special thanks to Dr. Wayne Sand. For many years, Wayne piloted the UWKA; and while he worked as a pilot, he also earned his Ph.D. in the department. Earlier this year, Dr. Sand donated to begin the Wayne Sand Fund for Student success. Thank you, Wayne, on behalf of our faculty and our students!

Thanks to the efforts of Drs. Dana Caulton and Daniel McCoy, the Department of Atmospheric Science is now offering gear highlighting the department logo! The gear store is open now through December 31. The shop offers shirts, jackets, and hoodies in a variety of colors and styles, all featuring the department logo (also in a variety of colors).

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Global atmospheric circulation carries moisture from warm, tropical regions and deposits it as precipitation far from its sources. Changes in evaporative fluxes and atmospheric circulation can bring either deluges or drought. To tackle this issue, GROWS will use the NASA GISS Earth System Model (ESM) coupled with machine learning techniques and observations to understand how much difference between models and natural variability exists. This can allow us to understand how much moisture affects the state’s water resources to predict how moisture fluxes will change on the scale, ranging anywhere from decades to centuries.

“Water availability and stress can have profound regional consequences for agriculture, tourism and quality of life. Even though the impacts are regional, the global atmospheric and oceanic climate interface moisture converges and precipitates,” McCoy says. “To be able to provide accurate predictions of water stress and availability on the time scale of years to decades, we need global ESMs that are accurate and reliable. To do this, we need to explore many possible ESM configurations and evaluate these configurations with our best observations.”

McCoy will fund Dani Jones, a UW junior from Gillette majoring in environmental systems science, to help with the project. Caulton will advise Samuel Ajibade, a UW Ph.D. student from Nigeria. Travis Aerenson, a Ph.D. student from the University of Washington, will start as a postdoc in spring 2024.

“Observations are key to benchmarking model output. However, there is a large mismatch between the scales at which observations are made and global models that produce output,” Caulton says. “We can use the historical record of aircraft and ground observations, along with new observations, to understand how much natural variability exists. This can allow us to understand how much difference between models and observations is acceptable and eliminate future projections that do not conform to reality.”

The research will create a framework for NASA and UW to offer predictions of future moisture convergence for the western U.S. The framework will be designed in a flexible way so that it can be applied to other regions around the globe. This will place UW in collaboration with NASA, as a center of hydroclimate modeling with local and global impact. Even though the impacts are regional, the global atmospheric and oceanic climate interface moisture converges and precipitates,” McCoy says. “To be able to provide accurate predictions of water stress and availability on the time scale of years to decades, we need global ESMs that are accurate and reliable. To do this, we need to explore many possible ESM configurations and evaluate these configurations with our best observations.”

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On 01 January 2021 the Wyoming Water Resources Data System and State Climate Office (WRDS/SCO) (www.wrds.uwyo.edu) officially became part of the Department of Atmospheric Science. WRDS started in 1968 to assist with the initial Water Planning efforts authorized by the Wyoming Legislature. Fifty-five years later, WRDS is still heavily involved in the water planning efforts lead by the Wyoming Water Development Commission/Office and is their technical arm. The unit consists of Director Tony Bergantino, Research Associate Issy Bruce Marston and Eva Cordtz, and a Digital Archivist, Barbara Muller.

WRDS/SCO serves the citizens and State of Wyoming by providing water and climate data together with expert analysis and other resources to a broad list of requesters consisting of State and Federal Agencies, local municipalities, news media, consultants, and private individuals. WRDS/SCO maintains the Wyoming Mesonet and also serves as the Drought Focal Point for the State, coordinating weekly input to the US Drought Monitor.

A variety of data and products can be found on the WRDS/SCO websites including the recently released Water and Climate Explorer. Through this mapping interface, users may retrieve a wide range of information on surface water amounts and quality; temperature normals, extremes, and inversions; precipitation frequency, amounts, and normals; water development products; dams and reservoirs; drought; groundwater depths, yields, and quality; snowpack and many others.

EARTH SYSTEM MODEL DEVELOPMENT IN ATSC

In fall of 2023, we welcomed two new tenure-track assistant professors: Drs. Stefan Rahimi and Masanori Saito. Dr. Rahimi grew up in Oklahoma, but spent his summers in the Snowies and south of I-80 across from Vedauwoo. He became fascinated by the atmosphere from an early age, becoming hooked on the subject through his love for opera. Energy and climate scientists have a mainstay of life growing up in central Oklahoma. He went on to earn his Bachelors and Master’s degrees at U Oklahoma and joined ATSC in 2015 as a PhD student. During his time at UW, he studied the interplay between aerosols, clouds, and the general circulation of the atmosphere using computer models of the atmosphere utilizing the NCAR/Wyoming Supercomputer. Finishing his Ph.D in 2019, he fled the state to California, joining the UCLA Center for Climate Science, where he continued to use supercomputers, but this time to study regional climate change in high-resolution. Stefan continues to study this subject now. Welcome back to ATSC Stefan!

Drs. Masanori ‘Masa’ Saito completed his Ph.D. in Geophysics at Tohoku University Japan in 2017, after which he came to the United States as post-doctoral researcher at Texas A&M University under the guidance of Dr. Ping Yang. Dr. Saito’s research mainly focuses on remote-sensing atmospheric sciences with a solid background in light-scattering, radiative transfer, and cloud microphysics. Masa is excited to join the department: “Remote sensing studies require high-quality observations and substantial computational resources. ATSC provides UW King Air (UWKA) cloud radar and lidar (WCR and WCL) observations, has access to the Derecho supercomputer, and hosts world-class engineering/science teams to support UWKA missions. I cannot imagine that there would be a better institution than UW in the world for observation-driven atmospheric science research and am so happy to be part of it.” Masa also notes that he was born and grew up in a small town in Japan, from which mountains (e.g., Mt. Fuji) were always seen. The Snowy Range and Happy Jack (and elsewhere in the US Mountain West) will be part of his life from now on.

Drs. Natalie Kille and Eric Beamesderfer joined the UW King Air Science team this past summer. Dr. Kille completed her Ph.D. from the University of Colorado, Boulder, 2020. Her work at CU focused on in situ measurements from the UW Air Research Aircraft. While Jobe, Ryan, and Lewis had ties to the local area; Kevin joined us from Portland, OR.

STUDENT NEWS

Ten students completed degree requirements in 2023 and joined the ranks of alumni...

NEWS FROM AROUND THE DEPARTMENT

The following eight students joined the department in fall of 2023:
- \(\text{Samuel Ajibade, with a M.Sc. from Tennessee State University (Advisor: Dana Caulton)}\)
- \(\text{Ebeneezer Boakye Yiadom, with a B.Sc. from Kwame Nkrumah University of Science and Technology in Ghana, West Africa (Advisor: Eric Beamesderfer)}\)
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- \(\text{Elena Goodspeed, with a B.A. from University of Colorado-Boulder (Advisor: Shane Murphy)}\)
- \(\text{Kyle Johnson, with a B.A. from Millersville University (Advisor: Anna Robertson & Dana Caulton)}\)
- \(\text{Shane Martrich, with a B.Sc. from Millersville University (Advisor: Jeff French)}\)
- \(\text{Evan Newman, with a B.A. from Millersville University (Advisor: Bart Geerts)}\)
- \(\text{Zakkary Trader-Gough, with a B.Sc. from Embry-Riddle Aeronautical University (Advisor: Shane Murphy)}\)
- \(\text{Victoria Wright, with a B.Sc. from Auburn University (Advisor: Dana Caulton)}\)

The new students are...

- \(\text{Adam Majewski, PhD (Fall 2023) Daniel McCoy (Advisor: Bart Geerts)}\)
- \(\text{Shreeta Ghimire, PhD (Summer 2023) Shane Murphy (Advisor: Bart Geerts)}\)
- \(\text{Timothy D. Corrie III, MS (Summer 2023) Bart Geerts (Advisor: Bart Geerts)}\)
- \(\text{Chuyan Tan, MS (Summer 2023) Daniel McCoy (Advisor: Bart Geerts)}\)
- \(\text{Geethma Werapitiya, MS (Spring 2023) Daniel McCoy (Advisor: Bart Geerts)}\)
- \(\text{Ci Song, MS (Spring 2023) Daniel McCoy (Advisor: Bart Geerts)}\)
- \(\text{Ethan Collins, PhD (Spring 2023) Zach Lebo (Advisor: Bart Geerts)}\)
- \(\text{Harrison Rademacher, M (Winter 2022/3) Shane Murphy (Advisor: Shane Murphy)}\)
- \(\text{Yingjie Shen, PhD (Winter 2022/3) Shane Murphy (Advisor: Shane Murphy)}\)
- \(\text{Song) are continuing in the department towards their PhD. (Advisor: Shane Murphy)}\)

Three of the MS completions (Corrie, Werapitiya, and Song) are continuing in the department towards their PhD.

At the completion of their degree requirements, the following individuals are now part of the Department of Atmospheric Science...

- \(\text{Harrison Rademacher, M (Winter 2022/3) Shane Murphy (Advisor: Shane Murphy)}\)
- \(\text{Yingjie Shen, PhD (Winter 2022/3) Shane Murphy (Advisor: Shane Murphy)}\)
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