



LARAMIE HIGH TIDINGS

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UPDATE ON THE NEXT-GENERATION UW KING AIR

Next summer, we will retire the University of Wyoming King Air (UWKA) research aircraft (tail number "N2UW"), after 45 years of service to the Department. Last year, as part of our 5-year NSF *Mid-Scale Research Infrastructure 1* (MSRI-1) grant to develop the next-generation UW King Air, the University purchased a King Air 350i aircraft (s/n FL-862, pictured below). The aircraft is now at Avcon Industries facility in Newton, Kansas where it is undergoing significant modifications. Special mission modifications, such as heavyweight landing gear, bigger engines, and new avionics, have been completed. The emphasis now is on a long series of modifications for atmospheric research, such as an extended nose and nose boom, dual nadir and zenith ports for remote sensors, and wing pylons (see images below). Our engineering team, pilots and mechanics are closely involved with the design of these modifications, some of which are uncharted, with bi-weekly remote meetings and quarterly in-person visits. The present schedule has the design of all modifications slated to be completed in spring of 2022 with fabrication and installation of the modifications slated to be completed in summer of 2022. Following that, another nine

months will be required to complete the certification with the FAA. Much progress has been made recently to ensure that the research aircraft will be certified by the FAA for the range of instrument payloads we envision.



Wing pylons and canisters



Here, acceleration meters are installed on the PMS-style canisters to determine flutter during test flights.



Exterior view of the nadir port

Uncertainties in the timing of completion remain. At this time, we expect the aircraft to be delivered to UW by March 2023, and to be ready for NSF-funded field deployments around December 2023. This aircraft will be more capable than N2UW, with additional ports, larger payload, more power, and longer endurance.

The MSRI-1 grant also enabled the development of new versions of our airborne cloud radars (WCR and KPR), new Raman and Doppler lidars (through collaboration with Prof. Zhien Wang at CU), new trace gas and aerosol capabilities, and a powerful aircraft-to-ground communication system. These developments are progressing well, although some are behind schedule due to the pandemic and/or to delays in the final design approval of certain research modifications.

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. We believe that the next-generation UW King Air will be a resource for the department's faculty and students, for the state of Wyoming, and for the NSF-funded community for decades to come, in research areas such as air quality, fugitive emissions, wildfires, severe storms, winter weather and cloud processes affecting water availability.

Progress with the next-generation UW King Air can be tracked at

<https://www.uwyo.edu/atsc/uwka/>

MESSAGE FROM DR. JEFF FRENCH, DEPARTMENT HEAD

Greetings and welcome to another issue of the “*Laramie High Tidings*”. I was appointed Department Head in October of 2021. I would like to begin by thanking Dr. Bart Geerts for his service as Department Head for the last 4 years. During that time, Bart initiated the effort of developing the department's 5-year strategic plan which more closely aligns the department with the University's mission, led the MSRI-1 proposal to fund the new King Air Research aircraft, was at the helm when 3 of our faculty received tenure, managed an additional two faculty hires, and introduced this annual newsletter. Thank you Bart!



Change continues to define the University. During this summer, the university announced plans for major restructuring across departments and colleges. You can read more about what this may mean for the Department of Atmospheric Science in a story below. Fall of 2021 also saw a return to in-person teaching on campus, following 2 ½ semesters of mostly remote courses. Along with a return to in-person coursework, the summer and fall of 2021 marked a return to field projects and deployments. The ongoing COVID situation across the country continues to make such work challenging and has required us to develop safety protocols to ensure the health of scientists and students alike. 2022 promises to continue presenting challenges associated with COVID as departmental personnel are deployed to locales across the United States.

THE DEPARTMENT OF ATMOSPHERIC SCIENCE IS 50 YEARS OLD

Fall 2021 marks the 50th anniversary for our department. Here is some history: in the early 1960s, the Bureau of Reclamation's Water Resources program developed an interest in snowpack augmentation



over the Rocky Mountains. UW Civil Engineering Professor John Bellamy and his graduate student Don L. Veal obtained a grant from the Bureau to study supercooled liquid cap clouds over Elk Mountain, a very windy, 11,000 ft high isolated peak NW of Laramie. Wintertime access was notoriously difficult. A shack was built on the mountain, dubbed "Schaefer Shack" after Vincent Schaefer, one of the pioneers of weather modification. This shack was designed to open large doors on both sides, to let cloud particles blow in. The idea was to shut the doors and then experiment with the seeding of the cloud particles. This never worked. But this effort probably inspired Don Veal, who had obtained his PhD in 1964 and had become a UW faculty member, to acquire an aircraft (a Beech C-45) in 1966 (from a scrap dealer in Arizona). While research facilities on Elk Mountain expanded, Don Veal also oversaw the installation of wing-tip cloud probes and the first computer-directed data system, and he flew the aircraft himself. In 1967, the *Atmospheric Resource Research Institute* (ARRI) was established, under the helm of Dr. Veal, and John Marwitz and Augie Auer were hired, initially as research scientists within ARRI. John and Augie both were CSU graduates, advised by Prof. Lou Grant, who led the weather modification research program at CSU. Two years later, Gabor Vali, a recent PhD graduate from McGill University, was hired as Asst. Prof., and a series of graduate courses in atmospheric science were developed within the Dept. of Civil Engineering. Then, in the Fall of 1971, UW Academic Affairs established an independent *Department of Atmospheric Resources*, with its own graduate degree program, initially at the MS level only, and by 1973 also at the PhD level. The name was changed to the *Department of Atmospheric Science* in 1975.



Don Veal and Augie Auer in the Beech C-45 aircraft in 1968. (Source: Sutherland 1993, *History of the UW College of Engineering*)

As a side note, Drs. David Hofmann and James Rosen in the UW Dept. of Physics and Astronomy started investigations into stratospheric aerosol in the late 1960s, using tailor-made instruments mounted on stratospheric balloons. In 1970 a balloon launch facility was built near the Laramie airport, not far from the newly constructed hangar for Beech C-45 aircraft. In 1991, Dr. Terry Deshler, who by then had inherited some of the balloon launching equipment and aerosol instruments, transferred from Physics & Astronomy to the Dept. of Atmospheric Science. Therefore, the two departments that are due to merge have some shared history.

In short, the Department is 50 years old this Fall! *Congratulations to the Department, to all its alumni, and to all its past and current employees for this Golden Anniversary.* John Waggener, archivist at the UW American Heritage Center, has been conducting interviews with several faculty and staff who were part of the Department's early days, to learn about its remarkable history and to answer the question of why this Department became the only one in the nation with a sustainable airborne atmospheric research program. We expect this oral history project to be completed and published this coming year.

UNIVERSITY OF WYOMING REORGANIZATION PLANS

The University of Wyoming, while facing a significant budget reduction on account of lower student enrollments (partly pandemic-related) and falling state contributions, is proceeding with a profound restructuring plan, including the incorporation of a number of physical science Departments (mathematics, chemistry, physics, geology ...) into our home college (the College of Engineering and Applied Science). A brand-new *School of Computing* will also be created, to be housed initially within our College, which will be renamed the *College of Engineering and Physical Science* (CEPS). This new School of Computing will emphasize big data and high-performance computing in STEM fields, and may benefit us through joint faculty appointments and graduate assistantships. Somewhat independently, the UW Advanced Research Computing Center (ARCC) is slated to receive a boost, and UW will develop closer ties with the NCAR Wyoming Supercomputer Center.

The initial restructuring plan was introduced during summer of 2021. By this fall, the plan had been modified, following comments and concerns raised by faculty, students, and state legislators. The base restructuring plan, now to be implemented in summer 2023, includes a merger between the Department of Physics and Astronomy (P & A) and the Department of Atmospheric Science. This will result in a department with about 18 faculty, a solid undergraduate degree program, and more external funding than any other Department on campus. All existing degree programs in the newly merged department will remain intact. This merger proposition was received positively by our faculty and the faculty of the P & A, in principle, although concerns were raised including how to physically merge the two departments (which are located in different buildings) and how to ensure financial security for the many facilities operated by both departments. Practical implementation details are being discussed, but will require much work over the next year and a half to be implemented successfully.

KING AIR DEPLOYMENTS IN 2021

The first NSF-funded field campaign with the UWKA since the start of the pandemic was *Transformation and Transport of Ammonia* (TRANS2AM), conducted in July-August 2021 [P/Is: Emily Fischer (CSU), Dana Caulton (UW), Illana Pollack (CSU), and Amy Sullivan (CSU)]. TRANS2AM studied the emissions and transformations of ammonia (NH₄) and chemistry of agricultural and urban pollutants downwind of large NH₄ emission sources such as cattle feedlots in northeastern Colorado. Halfway through this Laramie-based project, the UWKA wing was damaged by a bird strike. Therefore, the 2nd half of TRANS2AM (together with a small USDA-funded piggy-back project with similar objectives) will be conducted in May-July 2022.



That will be the last campaign for N2UW. Since the start of pandemic, the aircraft had been used only for a few instrument test flights and for two small home-based non-NSF projects, so the pilots and support crew were eager to see TRANS2AM, with 100 flight hours in total, materialize.

The last few months the King Air team has been busy preparing for N2UW's last NSF-funded remote field campaign, *CHemistry in the Arctic: Clouds, Halogens, and Aerosols* (CHACHA) (PI: Paul Shepson, Stony Brook University), to be conducted in Feb-April 2022 out of Utqiagvik (Barrow) in far northern Alaska. CHACHA aims to assess the extent to which Arctic change and fossil fuel extraction modifies multiphase halogen, nitrogen, and sulfur chemistry, as well as the role of aerosols and clouds in that chemistry. CHACHA is one of the more challenging campaigns we have ever conducted, in terms of payload, logistics, airspace, and staffing.

NEWS FROM AROUND THE DEPARTMENT

Congratulations to **Jeff French** and **Zach Lebo** for their tenure and promotion to Associate Professors this summer.

Two people joined the UW King Air team in the past year. **Anna Robertson** joined us in February as Temporary Research Scientist, focusing on airborne trace gas and aerosol measurements. Anna received her PhD in Atmospheric Science from the University of Wyoming in 2019, studying methane and volatile organic compound (VOC) emissions from oil and gas fields. She is playing a critical role in the preparation of the UWKA for an upcoming deployment to northern Alaska in winter/spring 2022. **Wade Dinius** joined us in October as a Machinist. Wade comes to us from the Boeing Company, and moved from Portland, OR. Wade's former career in aerospace makes him uniquely qualified to support King Air related work.

Two long-term Department employees have left us this year. **Bill Kuestner**, who had been our Machinist since 1999, retired in June. Bill's skills and experience as a machinist will be missed. And Dr. **Larry Oolman** retired in November. Larry joined the department in 1984 as a PhD student, completing his graduate work 4 years later. In 1988, Larry was appointed as a temporary Asst. Professor, teaching courses in weather forecasting, and serving as a King Air Project Scientist when not teaching. Larry developed the [University of Wyoming Weather Web](#), which at the time was well ahead of its time, serving weather maps across the web. The University Wyoming Weather Web server remains the 'go-to' site for archived atmospheric soundings across the world. As a King Project Scientist, Larry logged more than 2000 flight hours on the Wyoming King Air (N2UW), more than anyone else. On his last flight, he was celebrated with a dousing of water from a fire truck upon return from his last flight (image below).

We wish Bill and Larry the very best in their retirement.



STUDENT NEWS

The following graduate students joined us this Fall semester:

- **Timothy Corrie**, with a B.Sc. from the University of Northern Colorado (Advisor: Bart Geerts)
- **Braiden Denny**, with a B.Sc. from the University of Northern Colorado (Advisor: Zach Lebo)
- **Christopher Hohman**, with a M.Sc. from Plymouth State University (Advisor: Jeff French)
- **Brandon Lopez**, with a B.Sc. from the University of Wyoming (Advisor: Daniel McCoy)
- **August Mikkelsen**, with a B.Sc. from the University of Washington (Advisor: Daniel McCoy)
- **Morgan Shimkus**, with a B.Sc. from Carrol College, Montana (Advisor: Jeff French)
- **Kathryn Steinmann** with a M.Sc. from San Jose State University (Advisor: Dana Caulton)

Congratulations to **Thomas Mazzetti**, recipient of a Carlton R Barkhurst PhD Fellowship in Fall 2021.

Congratulations to the following M.Sc. graduates in the last year:

- **Mohammad Astaneh, M.Sc.** (Summer 2021) “Characterization of a new CH₄, and CO₂ flux instrument for the University of Wyoming King Air platform.” (Advisor: Dana Caulton) Mohammad is currently pursuing his PhD at UC Davis.
- **Robert Capella, M.Sc.** (Fall 2021, expected) “An improved environmental forecast parameter for snow squalls in the High Plains and Mountain West.” (Advisor: Bart Geerts) Bob currently works for SciTec Inc. in Boulder, CO as a Senior Staff Scientist in a Python developer role working on missile defense initiatives.
- **Priya Gurav, M. Sc.** (Fall 2021, expected) “Quantification of methane and ethane fluxes and ratios from the Permian Basin using a mobile transect method” (Advisor: Dana Caulton). Priya is looking for opportunities to work with an environmental consultancy or agency in the field of air quality and/or climate change.
- **Yazhe Hu, M.Sc.** (Fall 2021) “An observational study of the vertical structure and ice production processes of shallow convective post-frontal clouds over the Southern Ocean.”

(Advisor: Bart Geerts) Yazhe is planning to pursue a M.Sc degree in Geology at Brigham Young University starting in Jan '22.

- **Yishi Hu, M.Sc.** (Fall 2021) “A modeling case study of post-frontal mixed-phase clouds in the marine boundary layer over the Southern Ocean in MARCUS.” (Advisor: Zachary Lebo). Yishi will pursue a PhD with the same advisor.
- **Sam Marlow, M.Sc.** (Fall 2021) “Snowfall Measurements in Mountainous Terrain” (Advisor: Jeff Snider). Sam will pursue a PhD with the same advisor.
- **Megan McCabe M. Sc.** (Fall 2021, expected) “Isolating methane emissions from animal feeding operations in an interfering location in the Colorado Front Range” (Advisor: Dana Caulton). Megan will pursue a PhD with the same advisor.
- **Sarah McCorkle, M.Sc.** (Summer 2021) “Using convolutional neural networks to classify blowing snow from webcam imagery in Southeastern Wyoming.” (Advisor: Zachary Lebo) Sarah works with the National Weather Service in Monterrey, CA.

Congratulations to the following PhD graduate in the last year:

- **Coltin Grasmick, PhD** (Fall 2021) “Mixed-phased cloud microphysics over mountainous terrain emphasizing airborne dual-wavelength retrieval approach.” (Advisor: Bart Geerts). Coltin currently works with us as a Post Doc, on SNOWIE-related research.

ALUMNI NEWS

On 22 October, **Ken Pomeroy** (M.Sc. Atmospheric Science 1999) gave the 2021 H. T. Person Distinguished Speaker seminar entitled *The Crossover: Using Meteorological Principles to Predict Basketball Outcome*. Ken has worked in basketball analytics for many years, providing ratings for college basketball teams through [his web site](#) and consulting for NBA teams since 2003. His work has been used by coaches, media, and fans, and his ratings are used by the NCAA’s basketball committee to help select teams for its postseason tournament. His path to the sport began as a graduate student with us, followed by a stint as meteorologist for the NWS, where he learned the science of making predictions. In his talk, Ken demonstrated how many principles of weather prediction have direct application to predicting basketball outcomes.



We always like to hear from you. If you have something new to share with the Department and other alumni, post it on our [FaceBook page](#), or email Charlotte While at cfoster6@uwyo.edu.

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