

# AEROCOM

JOHN D. ODEGARD SCHOOL OF AEROSPACE SCIENCES

SUMMER 2019

# TABLE OF CONTENTS

04	Letter from the Dean
05	2019 Retirees
06	Army ROTC Airborne Once More
08	2019 Scholarship Recipients
11	Drones in the Fight
14	The Support of Excellence
16	Leading Research in the Clouds
19	Upcoming Events
20	Up, Up and Away
22	Research on the Rocks 12,000 Feet Up
24	Science but No Fiction
26	Aloha, North Dakota

## AEROCOM | SUMMER 2019

---

**INTERIM PRESIDENT** Dr. Joshua Wynne

**DEAN** Dr. Paul Lindseth

**ASSOCIATE DEAN** Dr. Elizabeth Bjerke

**ASSISTANT DEAN, EDITOR** Ken Polovitz

**DESIGN & LAYOUT** Courtney Olson

**COVER PHOTO** Paul Wesp

Aerocom is published for alumni and friends of the John D. Odegard School of Aerospace Sciences. Aerocom welcomes your suggestions, story ideas, alumni profile information and photos for use in future publications. Permission to reprint any portion of text or photography may be granted upon request. Visit our website at [aero.UND.edu](http://aero.UND.edu).

**Cover Photo**

UND Storm Chasers Experience group traveled to the middle of Kansas on May 27<sup>th</sup>. The photo was taken at the end of a successful storm chasing day.



## SALINA, KANSAS

The towering anvil structure of a severe storm can be seen over Eastern Kansas as the Storm Experience class of summer 2019 makes their way back to Salina, Kan. after a long day of chasing.

Photo by Paul Wesp





As we put the long winter of 2019 behind us, I'm delighted to highlight some of the very significant events that happened during the first few months of this year at UND Aerospace!

The UND Flying Team honored the University of North Dakota by winning its 17th National Intercollegiate Flying Association Competition Championship and its first Championship since 2010. It was very impressive to be present at the Awards banquet held at the University of Wisconsin, Madison, May 18th! The performance of our Flying Team was a true team effort with all team members scoring points and six team members capturing first place in individual flying and ground events! Very proud of our entire organization for once again capturing the National Flying Team Championship Trophy!

We kicked off 2019 with another special Odegard School Community Open House event. This early February event was a huge success with approximately 3000 people attending—mainly lots of children and parents! I want to personally thank the 160 UND Aerospace employees that volunteered to give up their Saturday to make the event—as one kid wrote in his feedback form—“the best day of my life”.

In March, Senator Hoeven visited UND Flight Operations and announced the re-establishment of UND's Army ROTC Flight Training program. This program will not only offer helicopter flight training to Army ROTC cadets but fixed wing and unmanned aircraft systems training as well. We are truly grateful for the Senator's unwavering support to re-establish this program.

The 2019 Spring Commencement ceremony was a very special event this year for our 100 plus Odegard School graduates. We bestowed UND's Doctorate of Letters degree on one of this country's Aviation Legends—Mr. Clay Lacy! It was truly extraordinary to have Clay here to visit with our graduates at our open house reception in Robin Hall. In addition, Professor Kent Lovelace was recognized as a UND Chester Fritz Distinguished Professor at the Graduation ceremony. Kent has given 42 years of dedicated service to building the Aviation program at UND and very deserving of this honor.

We congratulate Dr. Jeff VanLooy, Associate Professor of Earth Systems Science and Policy, for being elected as the University Senate Chair for the 2019-20 academic year. We are so proud of his leadership role at the University level.

Given the dynamic industry growth in each of the Odegard School disciplines, it is not surprising to see our significant growth in enrollment over the past two years. That growth will continue into the next academic year as well. Our Phoenix operation is especially experiencing rapid enrollment growth during the past few months. We welcome this growth but remain continually vigilant to ensure the safest possible flight training environment for all our students.

Finally, please join us in Oshkosh at the EAA AirVenture on Wednesday, July 24th, 6:00 pm at the Hilton Garden Inn for our Annual UND Aerospace reception. This has become a signature event for the Odegard School where alumni and friends connect and celebrate our ongoing success!

And a special thank you to each of you for your dedicated support of UND Aerospace and the John D. Odegard School of Aerospace Sciences! It is very much appreciated by our entire organization!

**PAUL LINDSETH | DEAN, JOHN D. ODEGARD SCHOOL OF AEROSPACE SCIENCES**

# CONGRATULATIONS 2019 RETIREES

**John Bridewell**, Professor of Aviation | 35 years

**Peggy Dohn**, Account Technician | 11 years

**Laurel Ann Dukart**, Administrative Secretary/Office Manager | 10 years

**Alan Frazier**, Associate Professor of Aviation | 11 years

**Terra Jorgenson**, Assistant Professor of Aviation | 10 years

**Jane Olson**, Administrative Officer to the Dean | 35 years

# CONGRATULATIONS KENT LOVELACE

Chester Fritz Distinguished Professor Award





# ARMY ROTC AIRBORNE ONCE MORE

Return of military flight training to UND brings modern elements to successful partnership

Wes Van Dell is sensing a change in the breeze at UND Aerospace's James C. Ray Hangar.

It's something more than the February wind chill.

The chief flight instructor for UND's helicopter training program is happy to have Army Reserve Officers' Training Corps (ROTC) Cadets in the cockpits and behind the sticks once more.

For 30 years, until 2010, UND led a one-of-a-kind scholarship program putting 15 cadets per year on the fast track to becoming Army aviators. Through appropriations in the National Defense Authorization Act, with the help of Sen. John Hoeven (R-N.D.), the program is making its return to campus this year.

"Historically, UND's helicopter training was founded as a military training program," Van Dell said, who's been an instructor at UND since 2007. "The way we designed our course structure mimicked what the Army would do at Fort Rucker (Alabama), the Army Aviation Center of Excellence."

In the past, cadets graduating through the program could commission into the U.S. Army and bypass the first three months of training at Fort Rucker with their UND flight experience.

This new iteration of the program—the only one of its kind in the country—will supply the Army with multi-dimensional officers.

## Preeminent education

Accepted cadets—once again capped at 15 per year—will have their flight training costs covered by federal funds, which is on top of their ROTC scholarship covering tuition and fees.

Lt. Col. Jason Murphy, commander of the Army ROTC unit on campus, says UND provides an elite, multi-faceted aerospace education for the Army. Cadets also will earn a degree in Unmanned Aircraft Systems Operations (UAS) to broaden their knowledge.

"For flight training, UND is already known as the preeminent aviation school," Murphy said. "For the cadets, it's a great opportunity to be a much broader-based aviation student. When we have students going into the Army with four years of aviation experience, already, they're more confident and have the ability to fill multiple roles."

Not only is experience in the burgeoning field of UAS a benefit to their overall education, but it can provide a tactical advantage. Officers coming from experience in UAS, fixed-wing and rotary-wing flying will be better equipped to make the right call in an aerial situation, Murphy says.

Beth Bjerke, associate dean of the John D. Odegard School of Aerospace Sciences, considers this a win-win for all involved. She says it essentially doubles the number of students learning to fly helicopters at UND. For the Army, it's value added on day one after cadets are commissioned.

"When I talk to any military contingency, this by far makes the most sense," Bjerke said of the UAS dimension added to the program. "The biggest users of UAS, and the ability to fly beyond-visual-line-of-sight for missions, is the military. This degree is very applicable to a career in the military."

## Fantastic timing

Megan McKenzie, a sophomore from Rosemount, Minn., is the first in her family to pursue aviation, the first in her family to pursue a military career and is now among the first cadets to be selected for the flight training program.



## UND ARMY ROTC

With appropriations forwarded by Sen. John Hoeven (R-ND), UND and the Army ROTC have brought back a once-popular helicopter flight training program for ROTC Cadets.

Photo by Shawna Schill/UND Today

By the time she graduates, she'll have certificates and/or degrees in all three modes of flight—fixed-wing, rotary-wing and UAS. She points out that with UAS still being new to the aviation industry, it will be valuable to have the expanded knowledge.

"I feel lucky to be here when the program is new," McKenzie said. "Next year, there will be a lot of people coming in for this opportunity. I feel honored to be chosen for it."

Senior Devin Wobbleton was thrilled to hear it was coming back. The partnership between the University and Army ROTC was what got the Huntingtown, Md., native keyed into UND in the first place. He says it is fantastic timing that its return happened before he graduated with an airport management degree.

"I would have graduated in December with a private pilot certificate; now I'm allowed to continue until August of 2020 and get as many helicopter certifications as I can," he said.

Wobbleton can't find a way to describe what it's like to fly UND's helicopters, other than the fact it doesn't handle like anything he's driven or flown before.

"When you're in an airplane, you're high up from the ground and it's a separate world," he said. "When you're in a helicopter, you're in between. You can be 10-25 feet off the ground or closer to airplane heights. It's absolutely fantastic."

### Professional partnership

Van Dell has been around UND long enough to see the helicopter program adjust from training cadets, to training civilians and now transition to a combination of aspiring pilots. He says there's a better foundation than ever for instructing ROTC Cadets.

"My past experience with cadets has always proven that they're extremely well-motivated," he said. "Their professionalism has always been exceptional, as well. The professionalism required to be a full-time flight student is something that, for an 18 or 19-year-old, you wouldn't really see anywhere else."

Professionalism is a quality Lt. Col. Murphy finds in partnering with UND Aerospace. The rapid turnaround from getting the defense appropriations to having cadets in the air proved UND's ability and capacity to be flexible and adaptable.

"Dr. Bjerke and her team have been outstanding in working with us and getting the program up and running, working with the students," Murphy said.

"It is very uplifting to see a great program like the Army Flight Training program return to the University of North Dakota," Dean Paul Lindseth told UND Today. "This has always been a cost-effective way to train future Army aviators, and we thank Sen. Hoeven and his staff for their outstanding support to bring this back to UND." ///

—Connor Murphy / UND Today

# 2019 SCHOLARSHIP RECIPIENTS

## FAMILY WEEKEND

### **Robert E. Absey Endowment**

Seung Yoon Lee  
Luana Liang

### **Hans Ahlness Memorial Scholarship**

Maria Cole

### **Air Traffic Control Alumni Scholarship**

Kayla Kirsch

### **Airline Pilots Association Scholarship**

Jeff Frane  
Isaac Kern

### **Maxie Anderson Memorial**

Scott Waldman

### **Rudy Andrews Aviation Endowment**

Benjamin Moncrieff

### **Robert Bolinger III Memorial Scholarship**

Brice Haraway

### **Robert J. Breckner Scholarship**

Carly Shukiar

### **Wilbur E. Brewer Memorial Endowment**

Tristan Brecht

### **Building Dreams Aviation Scholarship**

Ashleigh Meeks

### **Jim Bunke Aviation Award**

Dane Ellingson

### **P. Gail Clark Memorial Scholarship**

### **Krear Memorial Scholarship**

Natalie Odier

### **Paul & Frances Crow Scholarship**

Arthur Bebenek  
Justin Gray  
Kyle Hedberg  
Paul Kraemer  
Jordan Krueger  
Jakob Michel  
Jason Preston  
Kai Rackley  
Nicholas Rasmussen  
Patrick Verner

### **Ken Dahlberg/EAA Chapter 25 Aviation Scholarship**

Jack Caturia

### **Ellendale Flying Club Scholarship**

Samuel Kennedy

### **Captain Donald R. Emerson Aviation Award Endowment**

Jonathan Killea

### **Fargo Jet Center, Inc. Aviation Award**

Jacob Monsanto

### **50 Years of Excellence Endowment**

Ryan Knipping

### **James & Louise Fingarson Aviation Endowment**

Benjamin Barry

### **Five Main Ingredients Aviation Scholarship**

Megan McKenzie

### **Fran Fox Aviation Award**

Tyler Barry  
Jens Houck

### **Frasca Scholarship**

Max Bourne

### **Todd & Jan Gierke Scholarship**

Adam Douville  
Samuel Prigge

### **Daniel J. Gish Memorial Scholarship**

Aaron Raimist

### **Scott Greenan Memorial Aviation Scholarship Endowment**

Dukwoo Jeong

### **Toy Farmer Ltd. Scholarship**

Samual Olson

### **Robert E. Hartl Memorial Aviation Award**

Kihun Kim

### **Jared Herndon Scholarship**

Sean Sommerville

### **Don V. Hubbard Memorial Scholarship**

Jonathan DeLone

### **Annette Lynn Klosterman Memorial Aviation Scholarship Endowment**

Cassie Padula

### **Steve & Melissa Kuhlman Aviation Scholarship**

Trevor Binstock

### **Leader in Management Scholarship**

Travis Gylling

### **Leininger Family Aviation Scholarship Endowment**

Seiya Yamaguchi

### **Kent Lovelace Flying Team Scholarship**

Kaitlyn McGowan

### **MACH Aviation Scholarship**

Isabelle Adams  
Chasity Easterwood

### **Muhs Family Scholarship**

Andrew Hollingsworth

### **Newby-Forte Aviation Scholarship Endowment**

Alexis Hesse

### **John D. Odegard School of Aerospace Sciences CRJ 200 Training Scholarship**

Evan Rys  
Brian Shamblen

### **John D. Odegard Scholarship**

Ashton Croy  
Scott Keane  
Kevin Kohnke  
Zachary Kretchmar  
Luke McKenzie  
Victoria Omark  
Stephen Smith  
Kunal Sujjanani  
Mackenzie Walter

**Odegard School Scholarship Committee Award**

Gavin Oftedahl  
Trevor Redlin

**Gerald K. Olson Memorial Scholarship**

Christopher Zubke

**Al and Peg Palmer Scholarship**

Mathew Harford

**Piper Aircraft Scholarship**

Paul Wesp

**John R. Puttonen Memorial Scholarship**

Taryn Mata  
Emmalinne Miller

**Randall Family Aviation Scholarship Endowment**

Gretchen Cone

**John L. Robertson, Jr. Memorial**

Hanna Sempel

**Jacob Rueth Memorial Scholarship**

Ava Flaskamp

**David Schleisman Aviation Scholarship**

Jason Lieberg

**George J. Schroeder Memorial Scholarship**

Victoria Casement  
Julia Hedger

**Paul E. Schwietz Memorial Scholarship**

Jared Runstein

**Helen & Leonard Selkurt Aviation Scholarship**

Hailey Fitzpatrick  
Adelynn Mrosko

**Les & Joyce Severance Aviation Award**

Anthony Steinke

**Bruce A. Smith Aerospace Scholarship**

Jacob Koltes  
Ethan Rinke

**Martin & Doris Spargo Aviation Award**

Nathan Eversole  
Benjamin Hostetler

**Lamar J. & Ethel Torreson Stone Aviation Endowment**

Musharrat Ashraf  
Alex Bodin  
Charlotte Hatch  
Jonathan Ricard  
Angela Werner

**Bryce & June Streibel Aviation Award**

Mason Gourde

**Student Air Traffic Control Association (SATCA) Scholarship Award**

Victor Saeneboutrarath

**Student Aviation Management Assoc. Scholarship**

Scott Colbacchini  
Brennan Granger

**Lowell & Marjorie Swenson Aviation Endowment**

Derrick Christensen

**David Tallichet Memorial Scholarship**

Paul Kvamme

**Yuki Togo Aviation Scholarship**

Sydney Kosztolnik

**UND Aviation Alumni Advisory Board Scholarship**

Quinn Buckingham  
Adam Offerman  
Joseph Taylor

**UND Aviation Community Involvement Scholarship**

Joshua Savage

**UND Flying Team Award**

Joseph Sorrentino  
Garrett Turco

**UND Women in Aviation International Scholarship**

Jacquelyn Emery

**Weather Modification Aviation Award**

Noah Peterson

**Dwight Eric Widseth Memorial**

Claire Becker

**FedEx Purple Runway Scholarship**

Aiden Dorsey  
Gunnar Harris  
Zane Janneck  
Edwin Nova Abreu  
Samantha Ripley  
Tyler Barry  
Maria Cole  
Hailey Fitzpatrick  
Justin Gray  
Alexis Hesse  
Zachary Kretchmar  
Jason Lieberg  
Kaitlyn McGowan  
Jakob Michel  
Adelynn Mrosko  
Gavin Oftedahl  
Jason Preston  
Stephen Smith  
Patrick Verner  
Paul Wesp



# 2019 UNIVERSITY OF NORTH DAKOTA HOMECOMING

IT'S TIME TO COME HOME.

September 30 to October 5, 2019

HOMECOMING WEEK  
PRESENTED BY



[UNDalumni.org/homecoming](http://UNDalumni.org/homecoming)

**UND** ALUMNI ASSOCIATION  
FOUNDATION

# UNMANNED AIRCRAFT SYSTEMS DRONES IN THE FIGHT

## UND UAS effort spanned academia, business and government to keep watchful eye on flood

The overcast afternoon sky of April 8 arched the Red River as it spilled over its banks in Grand Forks. Battling wind gusts of nearly 14 miles per hour that swished around the basin was a small, 1.5-pound drone, hovering on the north side of the Sorlie Bridge. Close by, JJ Burrill gripped the control console and Paul Snyder peered at the live feed on a tablet.

“I was excited just because it was one of my real-world applications of flying a UAS in the field,” said Burrill, a sophomore studying unmanned aircraft systems (UAS) at the University of North Dakota.

That day, Burrill was part of a large flood-fight effort that has brought together the City of Grand Forks, UND, UND Aerospace Foundation, the Northern Plains UAS Test Site (NPUASTS) as well as several drone companies in the use of UAS to monitor river levels at key locales throughout the city.

“We see this as an opportunity for us to really help the community, first and foremost,” said Snyder, director of UND’s UAS program. “And, secondly, [this is] an opportunity for our students to get some real-world experience to go over and use the UAS for the purposes they are made for.”

### Community-wide start

The UAS component of Grand Forks’ flood fight came into existence in March during meetings between city leaders, the chiefs of police and fire departments and Erin Roesler, UAS standards and policy manager with NPUASTS, who oversees the project.

“UAS has been used in other emergency response efforts,” said Roesler.

“The difference this time is we are applying small UAS, which have a lot more

accessibility, there are a lot more operators of that type of technology and we are making sure the information is disseminated.”

The photos and videos obtained during drone flights, which began on April 6, are quickly made available to officials to inform their response to the rapidly swelling Red.

The six operators, who have received NPUASTS briefing and carry City of Grand Forks identification cards authorizing them to fly in the effort, must upload any captured imagery within 12 hours of their outing, Roesler said.

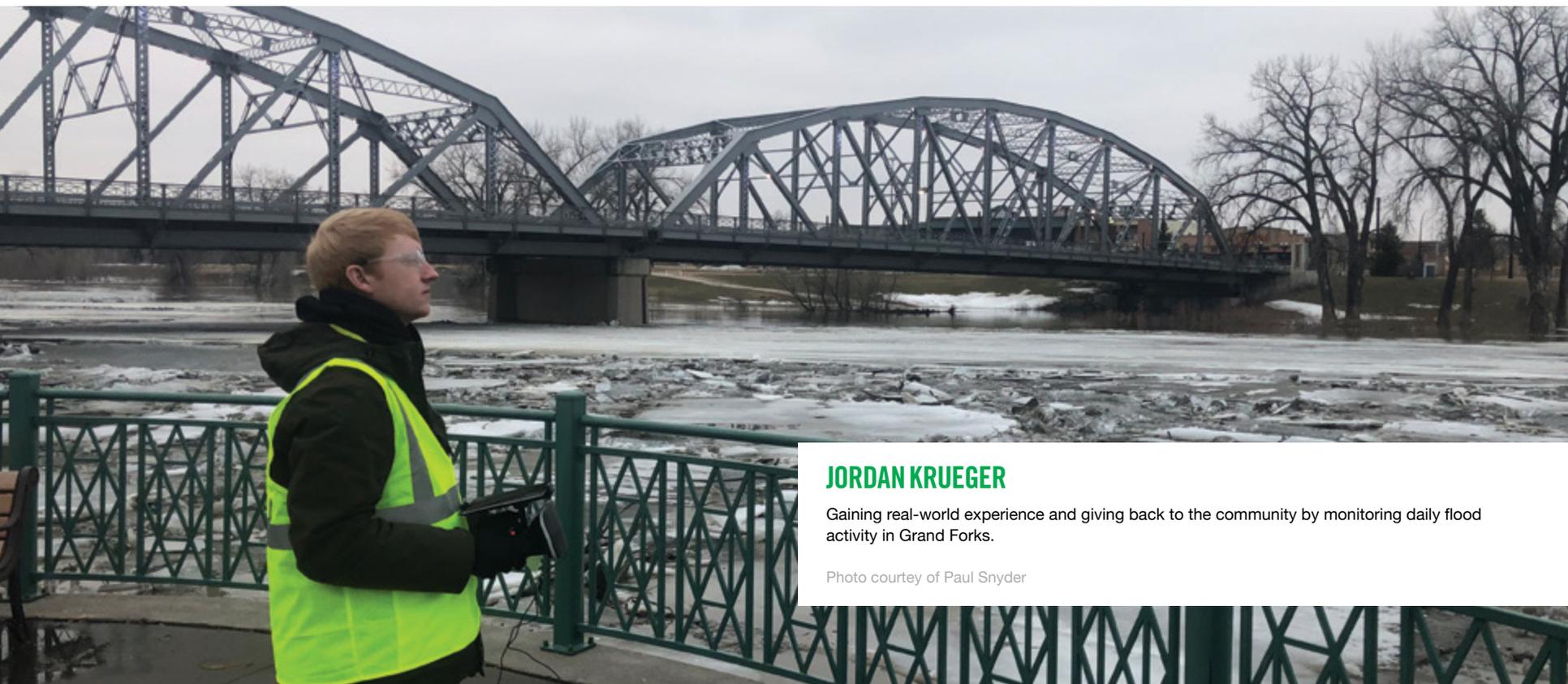
“They are looking for ice dams that are building up on the bridge structures,” said Roesler. “They are looking for where the water is. There are different concerns for the different areas, so we identified each one of those.”

The areas that have seen daily drone flights for over a week now encompass the Sorlie Bridge and the Kennedy Bridge, the north as well as the south pedestrian bridges, the flood walls and the Shady Ridge neighborhood, which rests on the wet side of a levee. UND representatives glide their UAS over the spans.

### Real-world experience for students

For the University, this presents a chance to engage students in a real-life predicament, the consequences of which far outweigh in-class assignments such as field mappings.

While UND has three operators certified to partake in the effort through NPUASTS—Snyder and flight instructors James Moe and Jordan Krueger—a small group of students in an introductory UAS course accompany them to actually maneuver the Parrot Bebop drones that can soar up to 400 feet.



### JORDAN KRUEGER

Gaining real-world experience and giving back to the community by monitoring daily flood activity in Grand Forks.

Photo courtesy of Paul Snyder



## UND UAS

In collaboration with the City of Grand Forks, UND Aerospace Foundation, the Northern Plains UAS Test Site as well as several commercial operators, a UND UAS team has been flying drones for over a week now to provide quick updates on the Red River's overflow in key locations.

Photo courtesy of Paul Snyder



## CITY WIDE FLOOD

Under the guidance of their instructors, UND UAS students are acquiring real-life experience as they operate drones in the city-wide flood fight this season.

Photo courtesy of Paul Snyder

"They are not only learning how to fly the UAS that we have at UND but we take them out in the field and they are immediately doing real-life application," said Krueger. "When they get [what] is basically a commercial operator license for unmanned aircraft, so they can get paid to fly, they already have a little bit of experience under their belt."

Some upperclassmen are also involved. One of them is Burrill, who took the beginners class last semester and joined the UAS-enabled flood fight on the invitation of Snyder and Krueger.

On April 8, together with Snyder, he conducted 10-minute flights on the north and south side of the Sorlie Bridge.

"It was pretty exciting," Burrill said. "I was pretty focused on getting the images that we wanted to get. It is pretty crazy how fast it all happened."

Cautious to prevent the drone from drifting past the middle of the river, where a potential emergency recovery would be hard, Burrill snapped bird's-eye pictures of the stream, banks and bridge.

Doing so is no small feat given the expectations of city officials, who sought a 360-degree view above and beneath the Sorlie Bridge, which had shuttered only hours before Burrill's drone took off that afternoon.

Later, Burrill and Snyder headed roughly a mile downstream to the Kennedy Bridge, where they discovered an ice jam logged under it.

### A unique effort

There are several facets—aside from UND students' participation—that render the UAS flood operation unique.

For one, it is a concerted UAS endeavor spanning academia, business and government and bearing implications for the Federal Aviation Administration, which works to incorporate manned and autonomous aircraft in the national airspace.

"Not only is it a coordinated, central effort here involving city government, UND and the UAS sector but there is also a direct flow of information to the FAA to try to help them to develop policies," said Bret Weber, city councilman and UND professor in social work.

Although this spring marks the inaugural integration of UAS into the City's flood-related activities, talks about such a collaboration have transpired for years, Weber said, in an attempt to create a "living laboratory" for University research and UAS enhancement in Grand Forks.

As a result, the current enterprise, which could stretch into recovery efforts after the Red subsides, lays the backbone for a UAS action-plan template not only for future local operations but also for other entities and communities.

"It is a real-life example now, not a scenario, not a research project, that we can show how federal laws and state local interest can be met simultaneously," said Roesler. "It just takes a little bit of education, a little bit of coordination but you can get it done. That is, I think, what is most important." ///

—Dima Williams / UND Today



# UND FLYING TEAM TOPS IN FLIGHT AGAIN

UND earns first place for first time since 2010, marks 17th national championship in NIFA competition

The University of North Dakota Flying Team earned its 17th national championship in SAFECON competition this past week, May 13-18, hosted at the University of Wisconsin-Madison. The team has now finished first or second in 30 of the past 36 years at the National Intercollegiate Flying Association's (NIFA) annual flight and safety competition and convention.

UND student aviators took first place in six of SAFECON's 12 events, with all 14 competing members contributing to the team's overall point total. Events tested a wide range of pilots' abilities both on the ground and in the air, from aircraft recognition to manually navigating cross-country flights.

This year, Associate Professor Lewis Liang won Coach of the Year among 30 institutions. Liang has coached the UND Flying Team for the past decade, and this year took on a new assistant coach in Ryan Guthridge. Guthridge last year won Coach of the Year with the University of Nebraska-Omaha before returning to his alma mater as assistant professor of aviation.

"This was a total team effort," Liang said. "We had a young team that had to work hard after losing experienced upperclassmen. They knew it was a rebuilding year, and we asked them to do their best—they gave it their best this week."

"The team had big shoes to fill," Guthridge said. "They spent the year grinding it out with grit and determination, and their work ethic brought home a championship. The feeling is unreal."

## Best of the best

Co-captains Steve Roche and Adam Douville led this year's championship team. Roche earned first place finishes in Aircraft Preflight Inspection and Short Field Landing; Douville took first in the Ground Trainer and Traditional Navigation events.

Other first place event finishes came from Benjamin Ediem (Simulated Comprehensive Aircraft Navigation), Garret Turco and Jason Preston (Unlimited Navigation).

High placings in other events solidified the team's overall first place finish. Paul Lindseth, dean of the John D. Odegard School of Aerospace Sciences, said they persevered against the country's best of the best to win it all.

"Congratulations to the students who made this such a great team effort, they

were each huge contributors," Lindseth said. "Hats off to Lewis Liang and Ryan Guthridge – they had a young team and were able to instill them with the confidence to win. It's a fierce competition that ensures a bright future for aviation nationwide."

## Humbling surprise

In winning Coach of the Year, Liang says it was a humbling surprise.

"It was extremely unexpected, but I'm humbled," he said. "My biggest concern was having it take away from the team focus. This event wasn't about me; it was about the team."

Kent Lovelace, Chester Fritz Distinguished Professor and Director of Aviation Industry Relations, said there's nobody more deserving than Liang to receive the distinction. Lovelace knows the Flying Team's winning tradition better than most, having coached UND through part of its seven consecutive championships from 1985-1991. He also served on the NIFA Council from 1985 through 2013, where he now serves as a non-voting committee member. He continues to judge at SAFECON competitions.

"Lewis worked tirelessly," Lovelace said of the NIFA Coach of the Year. "He's known as a gentleman among the coaches of the organization, and team members enjoy his guidance and mentorship – he's so deserving of the distinction. It continues another tradition, as Ryan Guthridge won it last year, Jim Higgins won it in 2010, and I've had the privilege of it, too—there isn't another team that's had this many ex-competitors earn that title."

Guthridge first experienced Liang as a coach when he placed as Top Pilot at 2009's SAFECON, winning UND its 15th championship title. He was excited to work alongside him on the coaching side ten years later.

Led by Liang and Guthridge, the following students earned UND's 17th national championship: Steven Roche (Co-Captain), Adam Douville (Co-Captain), Damien Gheler, Kaitlyn McGowan, Ben Eidem, Ryan Fitzgerald, Brendan Korinna, Joseph Taylor, Alexis Hesse, Kunal Sujanani, Jason Preston, Brian Shamblen, Joseph Sorrentino and Garret Turco. ///

—Connor Murphy / UND Today



## CLARK GEBHARD

Shift supervisor with UND Flight Operations' maintenance wing, helps oversee the crews inspecting 1,200-plus aircraft per year. Their mission is to keep safe planes available for student-pilots and the maintenance hangar open nearly 18 hours a day, seven days a week.

Photo by Connor Murphy/UND Today

# THE SUPPORT OF EXCELLENCE

UND flight operations, maintenance technicians continue to meet demand of nation's top flight school

Dan Kasowski is hard-pressed to recall how many flight hours UND Aviation logged 40 years ago, but he can remember the summers being quiet.

Now, from his office situated between the Bravo and Charlie ramps at Grand Forks International Airport, summers could best be described as a dull roar.

"Right now, we don't miss a beat," the director of maintenance for UND Aviation remarked. "We don't have what someone would call 'slow days.'"

Of course, slow days are all too possible for UND's aviators. North Dakota's weather can be an unforgiving force. But in rain, snow or shine, the maintenance facilities always run at capacity—18 hours a day, seven days a week.

## Keeping the pace

In Kasowski's four decades at the airport, he's witnessed the growth of UND as the nation's premier flight school. He currently oversees the departments responsible for over 100 airplanes and helicopters which are stored every night in 11 hangars at GFK, as well as the 40 aircraft at UND's Phoenix Flight Training Center and the flight simulators on main campus. It's an all-encompassing maintenance operation.

When he started, he was one of two full-time mechanics. Now he has 25 certified

aircraft technicians bolstered by eight full-time support staff, and a rigorous inspection process to boot.

"We are an FAA Part 145 Repair Station, which means we have a separate quality control department—a double set of eyes on everything we do," Kasowski said, describing the stages of an airplane going through maintenance, routine or otherwise. The operation is made up of aircraft technicians, inventory control, quality control, avionics, production control and the wash and detail bay. As for inventory, Kasowski says the latest tallies add up to \$1.6 million in aircraft parts stored on-site.

Just before going onto the floor of the maintenance hangar, a marker board showed the past week of daily flight hours. Nothing that week dipped below 500, which means both shifts of mechanics had their work cut out for them.

"If you add up all of those hours and divide by 60, our inspection interval, that's how many inspections we have to do to make sure we keep up," Clark Gebhard said. "We're usually seeing six to ten aircraft a day."

Gebhard has been a shift supervisor for five years out of his 15 at the airport, but he does as much as he can to minimize the title. He's not much different from anyone

else on the floor, he says – just a few more responsibilities. As he describes the ins and outs of his job, he’s moving station to station to help the other six mechanics complete their inspections. He also answers a radio call by hopping in the “mobile maintenance” van, driving onto the ramp to get air in a plane’s tire and inspect the alignment of its wheel assembly.

**“There’s pride in being the best flight school. We have pride in our facility, in the condition of our airplanes. Our safety record is something we don’t talk about enough – I don’t remember the last time there was a maintenance-related incident.”**

**DAN KASOWSKI, DIRECTOR OF MAINTENANCE**

“We keep up with this pace because we know our goal is to help out the student, and to get them in a safe, airworthy airplane at a reasonable cost,” he said. “We’re the Jiffy Lube of aviation. We’re doing a lot of oil changes and pushing things through, but we’re able to sell airplanes at a high return when we’re done with them at 8,000 hours or more.”

The best way to imagine this is selling a car at 200,000 miles, Gebhard says. Every eight years, the UND fleet is evaluated, and it’s currently transitioning from the high-wing Cessna 172S to the Piper Archer. With the amount of care each plane receives in its lifespan, and the diligence in tracking and recording its maintenance, it still has plenty to give to its next owner.

### **Safe and efficient**

The daily process Gebhard helps lead is one based on typical aviation inspection standards, but hyper-specialized for both the aircraft and the workforce maintaining them. For aircraft used for hire, an inspection is required every 100 hours of flight. An engine needs an oil change every 50 hours. At UND, to keep enough planes ready for student demand and also meet these figures, the inspections are split into four phases.

“If we were doing 100-hour inspections, you’d be looking at two or three days of that plane being down. One person is tied up on that, which doesn’t work,” Gebhard said. “When we split it into four inspections every 60 hours, we’re able to look at things just the same and more often. It’s more efficient when a technician is able to start an inspection and finish it that same day.”

Each phase examines a separate aspect, but also incorporates a thorough pre-

flight check of the entire aircraft. Phase one is the interior of the plane, everything from seatbelts to instruments. Phase two is engine detail. Phase three looks at the landing gear and wings. The final phase is another inspection of the engine.

“By doing that, we’re doing compressions on the engine like you would in a 100-hour check-up,” Gebhard says, adding that every UND aircraft comes through at least once a month. “We’ve been able to develop our own efficient inspection system that’s approved by the FAA. It works really well for us.”

### **Pride in flight**

Kasowski, in the halls of the maintenance building, points to a wall that’s running out of space. Every year, UND receives a Certificate of Excellence from the FAA for having 100 percent participation in training. He’s proud of the working relationship he has with the industry’s regulatory body, as well as the dedication to continued staff education.

“There’s pride in being the best flight school,” Kasowski said, highlighting everything from the combined years of staff experience to the whiteness of the hangar floors. “We have pride in our facility, in the condition of our airplanes. Our safety record is something we don’t talk about enough—I don’t remember the last time there was a maintenance-related incident.”

Gebhard also takes a moment to recognize the high levels of safety and compliance adhered to by maintenance staff, even in the daily grind of keeping up with demand.

“We’re part of a prestigious institution,” he said. “We may not be as seen as the other portions, but we’re an integral part of it. We’ll always have new instructors teaching new pilots how to fly, but you can always count on them having a safe plane.”

### **By the numbers**

Kasowski, Gebhard and all of maintenance play into the larger team effort of flight operations at UND. From dispatching to managing the flight line, flight operations maintains some impressive stat lines.

For starters, UND contributes to 90 percent of GFK’s traffic, making its control tower one of the busiest in the nation. The University logged over 111,000 flight hours in the 2018-19 academic year. The 19-member line team fuels at least 55,000 aircraft in a given year, handling over 2.4 million gallons of fuel and 4,500 quarts of oil.

In the maintenance hangar, Gebhard and fellow technicians inspected 1,210 aircraft in 2018, requisitioning over 43,000 aircraft parts. They replaced 494 tires, 1,320 oil filters and changed 567 spark plugs as they generated 33,164 work hours maintaining UND’s fleet.

Regardless of how those numbers might change down the road, Kasowski figures UND is ready for the challenge.

“We do a great job of forecasting because we have experience and knowledge throughout flight operations,” he said. “The interconnection between the skillsets and years of experience we have out here is what has made us successful.” ///

—Connor Murphy / UND Today



# LEADING RESEARCH IN THE CLOUDS

University plays key role in North Dakota's weather modification effort

Weather modification is magic to many folks in North Dakota. It's a key part of suppressing hail and delivering moisture, mostly in the western part of the state, where dry is normal.

University of North Dakota researchers and UND-trained pilots have long played a vital role in the state's weather modification efforts, notes Mike Poellot, longtime chair of the UND Aerospace Department of Atmospheric Sciences and an experienced weather research pilot.

In December 1973, UND's aviation program founder and first dean John D. Odegard was in Bismarck for a meeting of the state's Weather Modification Association. According to author Patrick McGuire in "Flight of the Odegard," North Dakota agriculture aimed to control the clouds in two critical ways: "Wring as much rain as possible from those clouds and tame them to the point where frequent storms of crop-killing hail are neutralized."

"The UND Aviation Dept. in 1973 got a National Science Foundation grant to explore the concept of teaching pilots how to fly research missions," said Poellot, who came to North Dakota during that period as a meteorologist for the state; he joined UND a bit later. UND's was the first and is still the only such weather modification pilot training program in the world.

"In fall 1974, UND started weather mod pilot training classes—there was no meteorology program yet back then, but a few classes in meteorology were given through the Dept. of Geography," Poellot said.

The next year, the program—a combination of classroom and hands-on training—

sent 8 summer interns to fly on seeding programs in North and South Dakota. Since then more than 400 UND weather mod student pilots have participated in that internship program.

## **The ND Cloud Modification Project and the ND Atmospheric Resource Board**

UND's weather modification research effort emerged from the state's need for effective hail suppression and cloud seeding for rain.

Operational cloud seeding got its start in North Dakota in the 1950s, when ground-based seeding activities began in the west. By the late 1950s, hail was recognized as the greatest weather-related threat to small grain crops; many growers suffered significant hail damage or total losses in back-to-back years.

In the mid-1970s, the state designed and started the North Dakota Cloud Modification Project. The Project was conducted by the Weather Modification Board, a part of the Aeronautics Commission. A total of 14 aircraft and 3 weather radars were used to seed and monitor clouds over 17 counties across the state. The project has conducted seeding every year since its inception in 1976. It now falls under the direction of the Atmospheric Resource Board (ARB), part of the state Water Commission and is headed by UND alum Darin Langerud. The Board licenses weather modification contractors and pCloud seeding operations and research activities.

## **Getting into research**

UND's commitment to weather and related research—such as weather modification and cloud physics—"took off" in 1974 when the school acquired its first weather



### WEATHER MODIFICATION INC. (WMI)

A WMI weather modification aircraft with equipment to dispense cloud seeding agents.

Photo by courtesy of Mike Poellot

radar system with support from the U.S. Bureau of Reclamation and the National Science Foundation—in a project dubbed “Skywater”—Poellot noted.

“That was the beginning of weather research at UND,” Poellot said. “We were part of the Skywater’s High Plains Experiment (HIPLEX), along with other plains states such as Texas. The federal government sent us their weather radar tapes, and we processed the data that they had collected. The Bureau also funded our pilot training program.”

#### UND weather research aloft

“In 1978 UND purchased a Piper Cheyenne II and next year its first Cessna Citation, both geared toward research,” said Poellot, who flew many weather research missions as part of his faculty assignments. Poellot still administers the weather modification pilot training program at UND.

“That Cheyenne did the cloud seeding and also collected data,” he said.

“The scope of the Department of Aviation’s involvement with weather modification research was greatly expanded when the University acquired the Cheyenne,” writes Donald Smith in a departmental history for the University’s centennial. “The aircraft was retrofitted with special sensing equipment and cloud seeding capabilities. Operation of the Cheyenne added a new dimension to the department’s research activity.”

The school officially became the Center for Aerospace Science in 1984, moving into the new Odegard Hall. In 1986 Tony Grainger, Professor Emeritus, was selected chair of the newly-formed Department of Atmospheric Sciences. He still teaches an occasional graduate-level class.

#### Risk mitigation

No doubt about it, airborne weather research and weather modification flying are risky endeavors, notes Poellot, which is why UND developed its weather mod pilot training program. As Poellot describes it, flying these missions—whether they’re for hail suppression or rain-making—takes careful decision-making to minimize the risks and decide exactly when and where in the clouds to fly the airplane and exactly when to launch weather mod operations.

Certainly, Al Palmer can testify to that. The retired head of UND’s Center of Excellence in Unmanned Aircraft Systems Research, Training, and Education, and former UND Flight Operations director (and a veteran of the North Dakota Air National Guard) used to fly the University’s Cessna Citation II research jet as part of the UND’s ambitious weather research program, managed by Grainger. Roger Tilbury, also a pilot, was a key member of that team.

“It was our job to tease out what’s important and useful from all the information we gathered aloft,” said Palmer.

#### Collecting data from the clouds

David Delene, who joined the UND team in 2001 as part of the Earth System Science Program (ESSP) before moving to Atmospheric Sciences, is a part of UND’s weather and weather modification research team. He develops and builds test instrumentation and the software that drives it.

“I do a lot of work with Weather Modification Inc. (WMI) in Fargo, both in modification operations as well as research—WMI provides the planes, we provide the science,” says Delene.

“We do a lot of instrument testing in my lab and during flights,” he says. “We also

make sure that the instruments are correctly installed aboard the aircraft. I help to determine what instruments are needed for a particular mission.”

In a 2016 article in the Journal of Weather Modification titled "Suitability of North Dakota for Conducting Effective Hygroscopic Seeding" Delene describes another key weather modification research program he was involved with: the Polarimetric Cloud Analysis and Seeding Test (POLCAST) project to learn more about the impact of hygroscopic cloud seeding at cloud base on continental convective clouds. This was a new kind of cloud seeding research that brought together UND, Weather Modification Inc., and Ice Crystal Engineering in 2006. Vital tools in that research were UND's radar system and the Citation research jet.



Delene, probes—among other weather-related phenomena—atmospheric aerosols, cloud physics, and weather modification. He's also working with unmanned aerial systems, or UAS, another key component of the UND Aerospace lineup of majors and research areas.

Delene recently received a \$1 million atmospheric research contract from U.S. Navy, bolstering new public-private weather forecasting partnership. The "Cape [Canaveral] Experiment 2019" combines strengths of UND and WMI to develop better cloud models and thus enhance forecasting. It's also a great opportunity for UND students to work at a high level, utilizing a combination of the best observational equipment in the field of atmospheric sciences.

Another Atmospheric Sciences faculty member, Professor Gretchen Mullendore, has been supporting the NDCMP operations. Gretchen runs a version of the Weather Research and Forecasting model (WRF) that is set up to run for the project area and surrounding region. The model output are used to help forecast the development of convective clouds that are the focus of the project seeding operations.

### The WMI connection

Patrick (Pat) Sweeney, Weather Modification Inc.'s (WMI) chairman, started out as a radar technician during his service in the Navy. Because of this expertise he was called upon to help put together the original UND weather radar in early 1975. He started his WMI career in Bowman, ND later that year while also working as radar technician for the UND radar. In 1979, he was named vice president of WMI and became a stockholder of the company. He moved the operation to Fargo upon

gaining controlling interest of the company in the early 1990s.

Sweeney, a Navy veteran, received his Bachelor of Science degree from the University of North Dakota (UND), in 1978 with a major in Industrial Technology. He received his commercial pilot instrument and multi-engine training while at UND. Several other WMI teammates, including Pat's brother James (Jim)—WMI executive VP—and the company's president, Neil Brackin, are UND alums.

### Core values

At its core, Poellot emphasizes, the University's weather modification pilot training program is first about developing a pool of pilots trained in cloud seeding operations. This is vital to the safe operation of the state's weather mod operations because North Dakota requires two pilots per aircraft. The program's interns—all trained pilots—fill in as second in cockpit.

"Weather mod pilots need to deliver the right amount of material in the right place, and to the right cloud at the right time, and do it safely," Poellot says. "It's all up to the pilot—where to fly and just as important where not to fly." ///

—Juan Pedraza

### The Department of Atmospheric Sciences

The acquisition of a weather radar by the Aviation Department in 1974 eventually led to the creation of the Department of Atmospheric Sciences. The radar was used as part of a training program for weather modification pilots and also to collect data for weather modification projects. These core areas of education and research continue in the Department of Atmospheric Sciences today. We now offer B.S., M.S. and Ph.D. degrees in Atmospheric Sciences and have a total combined enrollment of nearly 100 students. Our graduates are filling workforce needs, helping meet the needs of our society for accurate and targeted weather information, and increasing our understanding of weather and climate. They are working for private sector companies, Federal and state agencies, and academic institutions in a variety of job positions. Examples include NOAA hurricane hunter pilot, special events (e.g., PGA golf tour) forecaster, broadcast meteorologists, National Weather Service forecasters and managers, university professors, and research scientists. Our 11 faculty members are currently conducting cutting edge research in areas of satellite remote sensing, climate change, severe storms, winter weather (not a surprise!), convective clouds, atmospheric aerosols, airborne measurements (also not a surprise!) and weather modification. They are currently managing active research grants at a level of over \$5 million.

All of our successes have a foundation in students who are highly motivated and share a passion for understanding, observing, and predicting weather and climate. To complement their coursework, our students have many opportunities to apply what they learn in the classroom, including: participate in our daily video weather webcast, build a thermometer, run a weather radar, conduct research, teach an introductory lab course, run a weather forecast model, and launch a weather balloon. We look forward to exciting new opportunities and challenges for our current and future students, faculty and staff as we advance our science and serve society.

# STORM CHASERS EXPERIENCE

“The Storm Experience trip through the Atmospheric Sciences department provided an excellent opportunity for me to apply the knowledge I’ve gained in the classroom at UND to the real world. **Watching the development of a supercell** from start to finish with my own eyes was an incredible experience.”

PAUL WESP | COMMERCIAL AVIATION



## STORM CHASERS

Ben Remington, Kevin Mahoney, and Jared Swanson stop to observe and photograph the formation of a supercell structure in central Kansas.

Photo by Paul Wesp

# UPCOMING EVENTS

## SEPTEMBER

Potato Bowl  
14 | Grand Forks, N.D.

## OCTOBER

Sioux Awards  
3 | Grand Forks, ND  
Homecoming  
5 | Grand Forks, N.D.  
NBAA  
22-25 | Las Vegas, Nev.  
NBAA Alumni & Industry Reception  
22 | Las Vegas, Nev.

## NOVEMBER

UND Alumni Gathering  
6 | Museum of Flight, Seattle, Wash.

## FEBRUARY

UND Aerospace Community Day  
8 | Grand Forks, N.D.

# UP, UP AND AWAY!

Atmospheric Sciences students receive hands-on experience with weather balloons.



## RADAR

The antenna on top of Clifford Hall is part of UND's doppler weather radar that is used for classes and research.

Photo by Shawna Schill/UND Today

Not all Atmospheric Sciences students attending the University of North Dakota will pursue a meteorology career in which they'll need to know how to launch weather balloon. But they'll leave the university with hands-on experience of how it's done and an understanding of the importance of the activity to weather forecasting.

"It's the primary method used to get weather information," explained Fred Remer, associate professor of atmospheric sciences in the John D. Odegard School of Aerospace Sciences. "If we didn't have these balloons, then we wouldn't have forecasts. We wouldn't know what's going on in the atmosphere. Satellites would help us, but the balloons remain a critical component of our weather observing and forecasting method."

UND sophomores in the meteorological instrumentation class and juniors in the atmospheric thermodynamics class learn about the importance of the data – both how it's collected and how it's used. They also receive hands-on experience in launching, tracking and monitoring data collection as a balloon is carried by winds aloft over hundreds of miles on flights lasting two hours or more.

"We feel that this is a great opportunity for the students to get experiential learning," Remer said of the department-funded project that's been occurring the past four years. "That's why we're one of the better programs in the area. Students are at the top of our list. We've got to provide them with a quality education."

## 80 years of balloons

The National Weather Service began launching balloons equipped with radiosonde instrument packages about 80 years ago to collect data that includes temperature, relative humidity and wind direction and speed. Today, data sent back to a ground station by radio and GPS provides a vertical profile of the atmosphere from the surface up to 110,000 feet or higher.

Although the technology has changed over the decades, the importance of the information hasn't which is why the NWS continues to launch more than 180 weather balloons a day from locations in every state of the nation. Worldwide, there are about 800 weather balloon launch sites. In North Dakota, the NWS Office in Bismarck launches balloons each day at 7 a.m. and 7 p.m.



## THERMOMETERS

Though most meteorologists won't launch weather balloons—or make thermometers out of glass tubes—on the job, UND students receive the ground-level experience that puts their knowledge into practice.

Photo by Jackie Lorentz/UND Today

“If there's a severe weather outbreak, they'll send up an extra balloon launch around noon because it provides us with firsthand knowledge of what the atmosphere's doing,” Remer said. “This is our primary method for forecasting severe weather thunderstorms, tornadoes, large hail – all sorts of weather phenomena.”

A few weeks before the end of UND's spring semester, graduate teaching assistant Mark Bresnahan went through the steps of launching a weather balloon with sophomores in the meteorological instrumentation class. The students did everything from registering the GPS launch coordinates to inflating the balloon with helium to attaching the radiosonde, launching it and then observing the incoming data from the sixth floor of Clifford Hall.

“We have an antenna on Clifford Hall that connects to the radiosonde,” Bresnahan said. “It sends information back to the antenna, which displays on our computer screen. We have students fill out the parameters for each pressure level.”

### Firsthand experience

The class was a mix of students training to be pilots, meteorologists and air traffic controllers. Erin Doyle, Alexandria, Minn., who plans to pursue a career in meteorology, said, “Most meteorologists won't launch weather balloons on a regular basis, but this shows us how the data is collected that we look at on computers to make forecasts. It's just a good experience for that.”

Sam Peterson, North Branch, Minn., is in ROTC with the goal of becoming a pilot in the U.S. Air Force, a profession that will require him to deal with jet streams. “Knowing how it works and how the process is done really helps you understand how the data's gathered and what's actually going on in the atmosphere,” he



## BALLOONS

remain a critical component of how scientists observe and forecast weather. UND students receive hands-on experience in launching, tracking and monitoring data collection using this method, which dates back 80 years.

Photo by Jackie Lorentz/UND Today

explained. “Plus, if I can't be a pilot, I can still have a really good career in the weather field.”

Anthony Harris, Roscoe, Ill., is pursuing a major in air traffic control and a minor in meteorology. His interest in weather started when he was five and watching Jim Cantore on the Weather Channel covering Hurricane Katrina.

“We get firsthand experience on launching a radiosonde and the entire process that goes with it,” he said. “You can immediately see the sky conditions and get a live readout of what's going on, as opposed to sitting in class looking at a sample sheet that was taken probably decades ago. It's phenomenal.”

As an air traffic controller, Harris will be required to monitor the weather, advising arriving and departing aircraft pilots about conditions on the runway, in holding patterns and on approaches.

“To be able to go to UND and have this as a minor, as well as air traffic control as a major, I couldn't ask for anything more,” he said. “Having a broad knowledge and background in weather can make you a significantly better controller.”

Remer emphasized that there's an ongoing need for meteorologists with a knowledge of weather balloons. “This is one of those skills it helps to have when starting a job with the National Weather Service,” he stressed. “They will teach you how to do it, but for our students, it's almost seamless. They fit right in because they've done it before and know what it's all about.” ///

—Patrick C. Miller / UND Today



# RESEARCH ON THE ROCKS 12,000-FEET UP

Jeff VanLooy and Ph.D. candidate Lance DiAngelis featured in national public television doc on Rocky Mountain glaciers

After some seven miles of an onerous climb through patchy grass and craggy boulders, Lance DiAngelis, standing atop a ridge, gazed at a large sheet of ice.

“Wow, this is incredible,” he remembered thinking. “I am seeing my first ice.”

Someone from his fellow outdoorsmen scaling the Continental Divide high up in the Rocky Mountains in Wyoming, suggested he wait for the sight, hidden behind a narrow trail that for the next 15 miles snaked downhill and then up.

“I will never forget taking that first corner and actually seeing the main ice sheets, the [Dinwoody] glacier, I was really taken aback and awe-struck,” said DiAngelis, a Ph.D. student in the department of Earth System Science and Policy at the University of North Dakota.

At roughly 11,000 feet of elevation on the east slopes of the Wind River Range in western Wyoming, Dinwoody is among the biggest in the Rocky Mountains, which contains some of the most prominent alpine glaciers in the United States outside of Alaska.

In the late summer of 2016, when working on his master’s thesis at UND, DiAngelis reached Dinwoody – his very first glacier conquest – in a crew headed by Central Wyoming College’s Jacki Klancher. They studied the thickness of the glacier, which sprawled over 2 square kilometers (just over 1 square mile) and proved to be up to 70 meters (230 feet) deep.

## Through the lens

The expedition, DiAngelis’ first in the folds of the Winds as the range is often called,

was particularly significant for him – it allowed him to marvel at the formations he researched for his thesis on the alterations in glacier discharge in the last 30 years.

It also afforded him the opportunity to share his knowledge in front of a camera. This is because a producer with Wyoming Public Broadcasting Service trekked along, capturing the expedition that resulted in the 57-minute *Glaciers of the Winds* documentary.

Along the half-time mark of the movie, which premiered last September and has since screened across the country, DiAngelis appears, perched on a rock. Sporting a hat and shades, he explains that obtaining the depth of Dinwoody would help calculate its volume. The latter, he continues, presents a reliable measure of how much the glacier has retreated.

“[[It was important to relay] that unique first-time experience along with some of the research I was doing,” DiAngelis said. “I think that was really important to get that out because the Winds are a very unique mountain system.”

## A special place

What is special about the Wind River Range, a 160-mile stretch along the Continental Divide, beaded with roughly 60 glaciers, is its influence on the nearby communities, including the eponymous American-Indian reservation in the mountains’ foothills.

DiAngelis cited studies that suggest that meltwater from the Winds contributes some 10 percent of the annual river flow in the area, which receives a mere 8 inches of rainfall a year.

## JEFF VANLOOY

Observing and studying the glaciers of the Wind River Range is an onerous task that involves days of trekking up the mountains and collecting various measurements and samples.

Photo courtesy of Jeff VanLooy



Although at first glance, it might appear negligible, the glacial discharge feeds the streams for only a couple of months in the summer, when it supplies over a half of the water flow and makes a considerable difference for farmers and ranchers.

“I think it is important to push out that perspective of saying, ‘Hey, look, the [Wind River Range] glaciers might be small relative to [other alpine glaciers] but they are really important to not only preserving our natural ecosystems and landscapes but also to people in the region,” DiAngelis said.

### Far-reaching impact

But the glaciers of the Winds have been retreating. And, the forces that are shrinking them are impacting North Dakota too.

While only a minuscule amount of glacial water reaches the state, the snow that blankets the Rockies every winter thaws into a network of rivers, including the Missouri, which meanders through western North Dakota.

“In 2011, there was so much snow it actually did contribute to the flooding that occurred in Bismarck,” said Jeff VanLooy, associate professor in the Department of Earth System Science and Policy and DiAngelis’ faculty advisor.

Such seemingly remote fortes often lie removed from everyday considerations. But they should not, said VanLooy, adding that the need to spread awareness impelled him to participate in the Wyoming PBS documentary.

“If we cannot communicate to the people as to what it is that we are researching and why it is important to them, they are going to keep going along, doing what they are doing, thinking that the water is going to be there and all of a sudden one day it is not,” he said.

### Chance appearance

In a way, VanLooy’s appearance in *Glaciers of the Winds* came about as a coda, a year after DiAngelis scaled Dinwoody with the film crew.

After a chance meeting, at a conference, with Klancher, the Central Wyoming College professor and an acquaintance of VanLooy’s, he agreed to an interview.

In August of 2017, VanLooy, DiAngelis and a couple of others headed to Helen glacier in the Wind River Range to do research. At the start of the trail that would take them up to 12,000 feet above sea level, VanLooy talked to the documentary producer, Kyle Nicholoff.

He anticipated a five-minute chat. It lasted for an hour and a half, broaching topics like climate change, glaciers in the Winds and around the world, and the essence of water as a resource.

They parted ways but VanLooy would send Nicholoff a trove of archival footage from his voyages in the Winds.

That year, VanLooy’s cadre did not make it all the way to Helen – a swelling glacial discharge blocked their path.

Over 12 months later, in September 2018, the documentary debuted. It opened in Lander, Wyoming. VanLooy and DiAngelis watched it during its TV premiere that streamed live on Facebook. Neither of them knew how much of their insights would make the final cut, but the result delighted them.

“I was highly impressed; it was really well put together,” VanLooy said. “I was really happy to see that the word is getting out on the importance of these glaciers.”

### An experience of a lifetime

As educational as the documentary is, it is also a captivating chronicle of what it takes to do research high in an alpine terrain that VanLooy likens to the vista of Mars or the Moon, a landscape of ice and rock.

There is a mound of logistics to be ironed out. There are days of trekking, hauling equipment in backpacks that can weigh up to 80 pounds. There are samples and measurements to be collected and documented. There is the general discomfort of sleeping in tents and forgoing showers for a couple of weeks.

And yet, despite all those, glaciologists like VanLooy and DiAngelis cannot stay away from the objects of their research for too long. VanLooy, along with his research collaborator Greg Vandeberg, professor of geography and geographic information science at UND, are planning a trip to Continental glacier in the Winds this summer to study – and observe – how it has changed since 2014, when they last visited it. DiAngelis is going too.

“It is a love-hate thing,” said DiAngelis, who is rehabilitating a back injury in order to return to the Range this August. “When you are in the mountains for two weeks, all you can think about in the end is getting out. But you might be five miles on the road, leaving Wyoming and you are like, ‘I cannot wait to get back next year.’ It has definitely been on my mind as far as preparing myself and getting ready. I cannot miss that.” ///

—Dima Williams / UND Today

# SCIENCE BUT NO FICTION

## UND Space Studies students finish seventh mission in Inflatable Lunar/Mars Habitat

Just west of Interstate 29 and the University of North Dakota campus, there's a series of five white inflatable modules connected by tunnels. Antennas stretching skyward and the futuristic rover vehicle parked nearby give the area the appearance of a science fiction movie set. What happens at this site is connected to science, but is far removed from fiction.

For two weeks in April and May, three UND Space Studies graduate students were isolated in the facility known as the Inflatable Lunar/Mars Habitat (ILMH). They emerged to discuss their experience, as well as the experiments and exercises they conducted to help advance NASA's plans for future space exploration that includes scientific expeditions to the Moon and Mars.

Completing the seventh NASA-funded ILMH mission, the team was comprised of mission commander Stefan Tomovic, Pretoria, South Africa, and mission specialists Peter Henson, Carrington, N.D., and Jared Peick, Penacook, N.H. Although highway and train traffic were a short distance away, Henson said it wasn't difficult to feel isolated, especially at night when nothing could be seen out the windows. "Your imagination explores the idea that you're far out in orbit somewhere," he explained.

Travis Nelson, a research assistant with the Department of Space Studies in the

John D. Odegard School of Aerospace Sciences, served as mission control – the person who most frequently communicated with the team as it ran experiments related to geology, microbiology and horticulture. Team members were also monitored daily for mental, physical and cognitive abilities.

"Most of the research is geared toward future human space flight," Nelson said. "Since the Apollo era, there hasn't been a planetary mission since 1972. Getting back to the moon and getting onward to Mars is going to be critical. UND provides a foundation to this research and to answer some of the more challenging questions."

### Extravehicular activities

The team ran exercises known as EVAs – extravehicular activities – requiring them to leave ILMH to perform tasks that included gathering soil and rock samples, simulating repairs on habitat panels and driving the electric-powered rover. During the EVAs, one team member remained in the habitat while the other two donned spacesuits developed by Pablo de León, director of UND's Human Spaceflight Laboratory.

"The habitat is about the same size as the International Space Station or around the size of a 747 airliner," Tomovic noted. The ILMH has five modules, which include a core module for eating and sleeping, a plant production module, an

### INFLATABLE LUNAR/MARS HABITAT (ILMH)

The NASA-funded Inflatable Lunar/Mars Habitat (ILMH) is a short distance west of the University of North Dakota campus and contains five modules, as well as a rover vehicle.

Photo by Patrick C. Miller/UND Today



exercise module, a geology and microbiology lab module and an EVA module with a workshop.

“We’re isolated, but we’re not confined,” Tomovic said. “We’re able to walk around and get away from each other if we want to be left alone. We can eat our lunches and dinners together and then spread out to do our separate tasks.”

While each member specialized in certain scientific and technical areas, they assisted one another as a team when necessary. “We created a strong team, and I thought we worked really well together,” Peick said. “If you’re going to send people to Mars – which takes six months just to get there – you need to make sure they know how to work together, understand each other and complete tasks.”

Tomovic, who participated in the fourth ILMH mission, was responsible for engineering, which included preparing the spacesuits and the maintenance and repair of the habitat and its equipment. Peick’s background in biology and chemistry tasked him with running the lab where geology and microbiology experiments were carried out. Henson ran experiments in the plant production module related to in situ resource utilization (ISRU), growing plants to supplement the team’s diet and attempting to determine if Martian or lunar soil could be modified for growing crops.

All three team members emphasized that the two-week mission was a group effort, receiving assistance and support not only from the Space Studies program and the Aerospace School, but also from around the UND campus, North Dakota’s EPSCOR program and Space Grant Consortium, and NASA’s Johnson, Kennedy and Ames Space Centers. “ILMH is a proof of concept; it’s a test bed,” Tomovic said. “NASA can work out all the kinks here before moving to a higher fidelity research station.”

### Student opportunities

Nelson emphasized UND’s focus on opportunities for students. “At the university, our goal is to teach the young people so that they are at peak performance once they get out into the professional field,” he said. “UND provides a foundation to this research and to answer some of the more challenging questions. It’s nice to be able to provide the students with that, as well as reach out to some of the professionals at NASA and the larger contractors looking for these types of meaningful platforms and research capabilities.”

Tomovic views his experience with ILMH as a launch pad for his career. “It provided me with a nice base and an opportunity to get my foot in the door working with space-related projects,” he said. “I see myself working in the space industry, either with habitats or spacesuit engineering.”

Peick and Henson also plan to pursue careers in the space industry. Both will serve internships this summer at NASA’s Kennedy Space Center in Florida. Peick will explore the use of invertebrates – oysters – to purify water while Henson will study how to freeze carbon dioxide in a reactor that converts it to methane for rocket fuel.

Nelson noted that two \$750,000 grants from NASA enabled de León to build the ILMH system. “The neatest part is that the students built it,” he said. “There were a few things we subcontracted out to local companies. Otherwise, the students did the finishing, all the structural interior and the exterior. They can say on their resumes that they worked on a space habitat system.” //

—Patrick C. Miller / UND Today



### PETER HENSON

Horticulture experiments conducted and crops were grown to supplement the diet of team members in the plant production module. Mission specialist Peter Henson tends an experimental hydroponic irrigation system.

Photo by Patrick C. Miller/UND Today



### UND SPACE STUDIES

The team of UND Space Studies students who spent two weeks in the ILMH are, from the left, mission specialist Jared Peick, Penacook, N.H., mission commander Stefan Tomovic, Pretoria, South Africa, and mission specialist Peter Henson, Carrington, N.D.

Photo by Patrick C. Miller/UND Today



# ALOHA, NORTH DAKOTA

University of Hawaii students partner with UND Space Studies to test out-of-this-world farm concept

Future Mars and Moon colonists probably won't miss having fresh leafy green salads with their meals, thanks to a novel collaboration between the University of North Dakota and the University of Hawaii at Monoa (UH).

Four senior mechanical engineering students from UH spent a week in Grand Forks, N.D., this month testing their automated Box Farm in the NASA-funded Inflatable Lunar/Mars Habitat (ILMH). The facility is operated by the UND Department of Space Studies in the John D. Odegard School of Aerospace Sciences. The UH team's objective is to automate the process of growing and harvesting crops to supplement the diets of crews on missions to Mars and the Moon.

"Because this system is a proof-of-concept prototype, we want to prove the individual tasks it can do," said Preston Tran, the project's team leader who graduated from UH in May. "Once it's been proven, the system can be expanded to take care of hundreds or thousands of plants. When we can verify that it works in this habitat, then we'll know for sure it's possible."

Currently, the UH team is focused on growing small, leafy green plants, such as lettuce, collard greens, win win choy and basil, but it's also testing tomatoes, peppers and edible flowers. Tran expects that over time, a much wider variety of

plants will be grown using Box Farm's automated hydroponic system.

Over the past six years, Space Studies students at UND have conducted seven missions in the ILMH to assist NASA in simulating the conditions Mars and lunar colonists will face. One of the five modules in the habitat contains a lab for conducting experiments on growing plants to supplement the diet of space explorers. What's been learned is that raising and tending to plants is expensive and can occupy up to 60 percent of a crew's time.

## Better food, more science

"The use of automated systems can reduce the time needed and let the crew do research and scientific work instead of food production," said Dr. Pablo de León, director of UND's Human Spaceflight Laboratory. "If we find that this is the way to go, then we'll certainly incorporate it into future ILMH missions."

Before the Box Farm, individual plants received daily checkups to determine if they were healthy, nutrient levels were optimal and temperature and humidity were in the desired range.

"The way our system differs is that we have cameras located on the robot arm," Tran



## FARM CONCEPT

A collaboration between the University of Hawaii and the University of North Dakota tested the potential of Box Farm technology to grow fresh produce for future space missions to the moon and Mars.

Photo by Shawna Schil/UND Today

explained. “They take a picture of every plant and do a color analysis. We use an algorithm to determine the health of the plant based on the ratios of green and red.”

Any plant showing signs of disease can quickly be removed by the robotic arm. “Because we’re using a closed-loop hydroponic system to save water, we don’t want to enable any bacteria infestations to rapidly spread,” Tran said.

Tran noted that transporting the Box Farm from Hawaii to North Dakota served as a demonstration of its portability – an important consideration in space travel where volume and weight are at a premium. In addition, he noted that UH students served as the project’s mission control center by monitoring plant health from 4,000 miles away.

“The way we designed it was to easily interface with the shelving system here at UND,” Tran said “We bought a shelving system in Hawaii that was very similar to the shelving dimensions here at UND. In terms of putting the systems on the shelves, it was very smooth integration all the way through.”

### Box Farm applications abound

The results of the experiment impressed de León. “There’s probably no state more dissimilar to North Dakota than Hawaii,” he said. “We were able to put together a collaboration with these students who did an amazing job. Now we’re discussing possibilities of a future collaboration between the University of Hawaii and UND.”

According to de León, UND is working with Raymond Wheeler, a renowned plant physiologist and authority on astrobotany at NASA’s Kennedy Space Center in Florida. “He’s interested to see how this goes and how they can continue with this technology in the future,” he said.

Tran said Box Farm technology has applications on Earth, too, which is why some members of the team are looking into forming a company to commercialize it. The system could help assure that farm crops are being grown with optimal nutrients and in favorable environmental conditions. Tran envisions a day when Box Farm is a consumer product for home use.

The collaboration between UND and UH demonstrates the importance of IMLH as a venue in which to conduct space exploration research.

“We are so far from any NASA center, and yet we’re able to do interesting research, which you can’t do any place but here,” de León said. “People from all over the country and internationally are interested in the different kinds of research we’re doing.”

Other student members of the UH team in North Dakota were Sean Agpaoa, robotic subsystems lead; Gabor Paczolay, static subsystems lead; and James Thesken, system integrator and control subsystems lead. The senior design project team from UH included 12 mechanical engineering students, and one biology student. They were assisted by Trevor Sorensen, project manager at the Hawaii Space Flight Laboratory, and Kent Kobayashi, associate professor of tropical agriculture and soil sciences in the UH College of Tropical Agriculture and Human Resources. ///

—Patrick C. Miller / UND Today

A photograph of an astronaut in a white spacesuit standing on the lunar surface. The astronaut's helmet visor reflects the lunar module and the Earth. The moon's surface is covered in dust and small rocks. In the upper right corner, there are several white diagonal lines. The text '50TH ANNIVERSARY HUMANS ON THE MOON' is overlaid in large white letters.

# 50TH ANNIVERSARY HUMANS ON THE MOON

What does this astronaut and the UND Space Studies Department have in common?



@UNDaerospace