Spring 2020 Vol. 61 No. 1

WINDswept

The Bulletin of the Non-Profit Mount Washington Observatory

THE NATION'S PREMIER HIKING EVENT

20th Annual SEEK the PEAK

MOUNT WASHINGTON • NEW HAMPSHIRE

JULY 17–18, 2020 • WWW.SEEKTHEPEAK.ORG • VENDOR EXPO JULY 18

ANCHORED BY:

BACKPACKER Tour GET OUT MORE

EASTERN MOUNTAIN SPORTS®

Mt. Washington Auto Road

Oboz® FOOTWEAR

With Support From: Mount Washington Radio Group • Mason & Mason Insurance
FirstLight • White Mountain Oil & Propane • Martini Northern

MWOBS
MOUNT WASHINGTON OBSERVATORY

The Mount Washington Observatory is a private, non-profit scientific and educational institution organized under the laws of the State of New Hampshire. Its mission is to advance understanding of the natural systems that create the Earth's weather and climate, by maintaining its mountaintop weather station, conducting research and educational programs and interpreting the heritage of the Mount Washington region.

Membership in the Observatory is open to all. Members receive: an annual subscription to *Windswept: The Bulletin of the Mount Washington Observatory;* a 20 percent purchase discount at Observatory shops; Observatory tours; free admission to more than 300 science centers through ASTC Passport Program; free admission to Extreme Mount Washington; exclusive content on MountWashington.org; and an opportunity to be an Observatory volunteer. Members are encouraged to help support the Observatory, attend its Annual Meetings and visit the Observatory, Extreme Mount Washington and Weather Discovery Center in North Conway.

ANNUAL MEMBERSHIPS:

Science Society $2500.00
President's Club $1000.00
6,288 Club $500.00
231 Club $300.00
Summit Club $150.00
Family/Dual $75.00
Individual $50.00
Senior $35.00
Student $30.00

Members will receive the three issues of *Windswept: The Bulletin of the Mount Washington Observatory,* for the year following the quarter in which they join. Please make checks payable to the Mount Washington Observatory and send to Mount Washington Observatory, PO Box 2310, North Conway, NH 03860-2310, or join at www.mountwashington.org.

Windswept: The Bulletin of the Mount Washington Observatory (ISSN 1098-7215, USPS 330-710) is published three times a year (spring, summer, fall/winter) by the Mount Washington Observatory. Single-copy price is $4.00, or $3.00 for members. Periodical postage paid at North Conway, NH, and additional mailing offices.
Editorial office to which all correspondence and address changes should be mailed is PO Box 2310, North Conway, NH 03860-2310 or submit via email to windswept@mountwashington.org.
 Printed by Minuteman Press, North Conway, NH 03860.
Photographs are by Observatory staff photographers or from the archives, unless otherwise indicated.

WINDswept

Table of Contents

FEATURES

NEWS

EDUCATION

WEATHER

DEPARTMENTS

Mount Washington Observatory
2779 White Mountain Highway | PO Box 2310
North Conway, NH 03860-2310
603-356-2137 | email@mountwashington.org | MountWashington.org

Weather Discovery Center
2779 White Mountain Highway
North Conway, NH 03860-2310
603-356-2137 phone
603-356-0307 fax

Summit Facility
Mount Washington
603-356-2137 phone

WINDswept

Editor: Marty Basch
Graphic Design: Brenda Court
Phone: 603-356-2137
Email: windswept@mountwashington.org

Contributors:
Marty Basch, Samantha Derrenbacher, Brian Fitzgerald, Dr. Eric Kelsey, Bill Ofsiany

Cover Credit: Ryan Knapp

Staff

Ian Bailey *Weather Observer & Meteorologist/Education Specialist*
Samantha Brady *Retail Manager*
Jay Broccolo *Weather Observer & Meteorologist*
Will Broussard *Outreach Coordinator*
Patti Capone *Weather Discovery Center Attendant*
Dr. Peter Crane *Curator*
Linda & Hank Dresch *Volunteer Coordinators*
Brian Fitzgerald *Director of Science & Education*
Krissy Fraser *Brand Manager*
Pete Gagne *Hardware Systems Specialist*
Keith Garrett *Information Systems Administrator*
AJ Grimes *Weather Observer & Meteorologist*
Craig Hill *Snowcat Operator*
Dr. Eric Kelsey *Lead Research Scientist*
Ryan Knapp *Weather Observer & Meteorologist*
Larry Martin *Weather Discovery Center Attendant*
Tom Moughan *Weather Discovery Center Attendant*
Tom Padham *Weather Observere & Meteorologist/ Education Specialist*
Jon Powers *Snowcat Operator*
Sharon Schilling *Executive Director*
Rebecca Scholand *Summit Operations Manager*
Mary Anne Sledzinski *Finance/Administrative Assistant*
Brenda Sullivan *Director of Finance & Administration*
Stephanie Turnbull Fitzgerald *Membership & Database Coordinator*
Steven Whitaker *Facilities Coordinator*

Officers and Board of Trustees

Chairman: Gary MacDonald *Conway, NH*
Vice Chairman: Rob Kirsch *Concord, NH*
Treasurer: Drew Landry *Keene, NH*
Secretary: Paul T. Fitzgerald *Laconia, NH*

Ed Bergeron *North Conway, NH*
Alexandra Breed *Gilford, NH*
Erica Broman *Longmeadow, MA*
Michelle Cruz *Conway, NH*
John Gorman *Boston, MA*
Brad Griswold *Lancaster, NH*
Michael Matty *South Hadley, MA*
Jack Middleton *Freedom, NH*
Peter Middleton *Portsmouth, NH*
Beth Newhouse *Gorham, NH*
Ken Rancourt *Center Conway, NH*
Marsha Rich *Chichester, NH*
Mary Stampone *Dover, NH*
Karen Umberger *Kearsarge, NH*
Brian Underwood *Rye, NH*
Howie Weymss *Randolph, NH*
Al Wheeler *Cumberland Center, ME*

Life Trustees

Dr. Charles W. Burnham *Durango, CO*
Brian K. Fowler *Grantham, NH*
Guy Gosselin *Gorham, NH*
Phil Gravink *Jackson, NH*
Christopher Hawkins *Lancaster, NH*
Kenneth Jones *Amherst, MA*
Gail Langer *Stoneham, ME*
Gail Paine *Intervale, NH*
Leslie Schomaker *Jackson, NH*
Kendall D. Smith *Melrose, MA*
Dr. Bryant F. Tolles, Jr. *Concord, NH*
Dr. Mark Van Baalen *Rockport, ME*

All About Weather and More

Windswept *Editor Marty Basch*

BY **MARTY BASCH,** EDITOR

The weather is constantly changing around here. So it's no surprise that we have to change with it. That's where a new summit weather wall comes into play. The wall, a staple for years, had to be updated.

With new instruments and huge television monitor, the finishing touches on the wall were happening as the deadline for this issue was at hand. In these pages, read about the new wall that makes more efficient use of space at the summit and new technology. We're looking forward to it enhancing our outreach opportunities.

Also exciting was the Observatory's involvement in the 100th meeting of the American Meteorological Society in Boston. Several staff attended the January event and participated in the career fair and presenting on several subjects. AMS brings together scientists, broadcasters, students and other weather lovers and professionals with the aim of "...promoting and disseminating information about the atmosphere, oceanic and hydrologic sciences." Lead Research Scientist Dr. Eric Kelsey and Director of Science & Education Brian Fitzgerald write more about the Observatory's participation.

A snowcat ride to the summit is a bucket-list item for many members. A new exhibit in the Weather Discovery Center called "Discovering Life on the Alpine Tundra" gives visitors a chance to take a virtual guided tour of the commute up the Mt. Washington Auto Road. The display gives visitors a chance to learn about the unique flora and fauna found at elevation while viewing three screens within the comfort of the WDC.

The Observatory's mesonet network scattered amongst the White Mountains is a way to collect valuable weather data. But it does have its share of challenges. Pete Gagne is the man in charge of making sure they're running in all sorts of conditions. Frosty Cannon Mountain is something of a challenge. In his regular column about the mesonet Pete tells of how an Observatory partner helps get the job done in measuring wind speed and direction.

We didn't forget it's spring. Soon a rare butterfly will be spotted on the summit—the White Mountain fritillary. The Observatory has partnered with New Hampshire Fish and Game to study this hardy butterfly. Researcher Samantha Derrenbacher provides a glimpse into the important work done on top of Mount Washington.

So take some time with these pages as we spring into spring.

Visualize the Observatory's Future

Executive Director Sharon Schilling

BY **SHARON SCHILLING,**
EXECUTIVE DIRECTOR

A belated welcome to 2020—the year of perfect vision and undeniable clarity—or so others would have us believe. By some accounts we have entered a new decade. No longer in the twenty-teens, we are now in the new Roaring Twenties.

What will this decade bring? We look forward with anticipation and yes even a bit of anxiety. But, we stand in a place where we can shape our own destinies, invent our own futures and live our dreams. Never in the history of humanity have we been able to achieve so much so quickly. To dream it is to be able to one day do it.

I have for years talked to people about the fantastic capacity of the human mind. All of the things that surround us were once just a thought in someone's mind, an idea, a vision of what could be.

Vision is a powerful tool for shaping your future. By focusing on what the future could or should look like, I believe that we also focus our actions on those efforts that will help us achieve the future we are looking for.

Athletes do it all the time by visualizing themselves winning over and over again. You can see it specifically when you watch an NFL kicker. They almost always visually line up their kick with their hand and eye, then take several steps back and see their kick in their minds.

Dieters like to display pictures of their thinner selves for motivation. The actor Jim Carey wrote a fictitious check to himself in his early days. That check was made payable to him in the amount of $7 million dollars. He folded it up and put it in his wallet and every day he took that check out and looked at it. About eleven years later, he would indeed receive a check for that amount, up front, for his role in "Dumb and Dumber."

Wolfgang Mozart was so good at visualization that he could and often did compose entire symphonies in his head and only writing them down when necessary. In fact, it is believed that because he had such disdain for the time it took to "copy out" his works, many of them died with him.

The point to all of this is that having vision is a powerful tool to achieve your future. For us, that vision centers around the work we do in weather, climate data, expertise and information. To achieve that vision, we will continue to focus forward on three types of

science and research—hosted, where we provide facilities and resources to outside scientists; original, where we develop our own research and lead it; and hybrid, where we combine the other two types.

Using this model, we remain open to original ideas, validation of other efforts and a combination of both of those. In January, six staff members and I attended the American Meteorological Society's centennial celebration in Boston.

It was important for MWOBS to exhibit, host a career table and participate in WeatherFest while we were there. Each event offered us an opportunity to showcase the amazing institution we have, highlight our work and seek out other opportunities by visiting other booths and meeting with those companies and organizations.

I'm enthusiastic about those discussions and what it will yield going forward. Simply having them all recognize and understand that we are a non-profit and NOT part of a state or federal government entity is huge. Igniting their imaginations with regard to science, partnered research and educational outreach undoubtedly benefits us going forward.

I was especially excited to talk face-to-face with the leadership at Blue Hill Observatory about potential data partnering opportunities. Comparisons and analysis of their 130 years of data to our 87-year record give me goosebumps just to think of the possibilities. I'm excited and I hope you are too!

The point to all of this is that having vision is a powerful tool to achieve your future. For us, that vision centers around the work we do in weather, climate data, expertise and information.

As you read the rest of *Windswept* you will get more information about the week we spent talking and listening. Enjoy your read and discover other great things going on at MWOBS!

As always, we cannot do this without your support. Your membership, volunteerism and contributions are vital to our efforts and I am humbled by you all.

Thank you and happy reading!

New Exhibit Brings Alpine Tundra to Warm WDC

"Discovering Life on the Alpine Tundra" uses three HD TV displays to capture the experience of a snowcat ride to Mount Washington's alpine zone.

A new Weather Discovery Center exhibit called "Discovering Life on the Alpine Tundra" takes visitors on a guided virtual tour of the geology and natural history of Mount Washington's alpine zone.

Comparable in style to the snowcat simulator found on the summit in Extreme Mount Washington, visitors will learn about the unique flora and fauna found above treeline as they experience a snowcat ride up the Mt. Washington Auto Road in winter.

Three angled 50-inch HD TV displays in the mini-theater space provide an ultra-wide-screen effect with casing work meant to resemble the mechanical feel of a snowcat.

There are two benches and standing room beside for small groups of up to 10-12 people.

"Much like our staff on their trips to the summit, visitors are able to see how wind, ice and cold shape where trees are and are not able to grow," said Director of Science & Education Brian Fitzgerald. "They will see glacier-carved valleys thousands of feet below, and experience the poor visibility and big snow drifts that snowcat operators often face."

Mount Washington's tundra-like environment up the 7.6 mile Auto Road is similar to traveling nearly 1,000 miles

to northern Quebec and Labrador. The mountain's extreme habitat hosts some species that are either found in other tundra-like environments or exist nowhere else in the world in the case of species like the Robbins' or dwarf mountain cinquefoil and White Mountain fritillary butterfly.

The ride up the road showcases various areas.

Featured in the video is one of the Observatory staff's favorite rock formations known simply as "squiggly rocks," found at Cragway Corner along the Auto Road. These layered and wavy rocks show a clear example of how metamorphic rocks get their name. Intense heat, pressure, time and other geologic processes make this a rather conspicuous point of reference on the Auto Road which is helpful to pick out when navigating tricky conditions on the mountain.

"Visitors to the WDC often wonder how staff get up and down the mountain, especially during the winter months," said Fitzgerald. "This exhibit invites visitors to experience the Auto Road like Observatory staff would as they travel up the mountain for their snowy shift change commute."

Fitzgerald and Outreach Coordinator Will Broussard created the content while staff including Facilities Manager Steven Whitaker were instrumental in constructing the exhibit.

The project was funded and supported by New Hampshire Charitable Foundation, Dorr Foundation, Goldberg Charitable Trust, McInitch Foundation and HAM Charitable Foundation. Tom Guilmette shot the video and Roy Prescott provided narration. Appalachian Mountain Club Alpine Ecologist Doug Weihrauch also helped. The Observatory also wishes to thank the Mt. Washington Auto Road and Mount Washington State Park for allowing us to shoot video on their properties.

The winter footage was captured in early 2018 using three cameras to film a greater than 180-degree view out of the side and front cockpit of the snowcat.

"Tom Guilmette returned in late spring of 2018—June—to capture the alpine flower bloom which features prominently in the video's discussion of plants that are able to withstand the many feet of snow that collects on the mountain each winter," said Fitzgerald.

A large portion of the exhibit was designed and constructed by 42 Design Fab Studio of Springfield, Mass. The signage was designed by Devon Clough of Devign Design & Visual Solutions.

Learning with Arctic Wednesdays Under the Dome

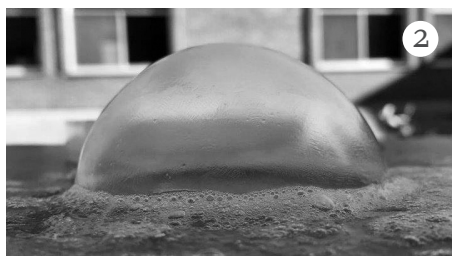
As part of the Observatory's Arctic Wednesdays program which introduces teachers and ultimately their students to the Arctic landscape of Mount Washington, participants learned about ice crystal formation and were able to apply what they learned in the classroom.

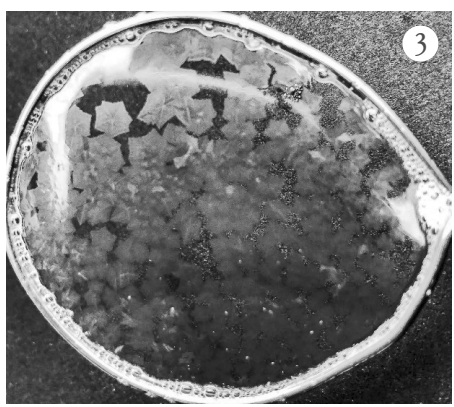
After making bubbles, participants watched how ice crystals were formed on the bubble. By using W.A. Bentley's snowflake thermometer, they were about to figure out the temperature of where they were.

In winter, two area science teachers from various schools and grades join Observatory staff on select Wednesdays as they make their weekly commute by snowcat to the summit along the Mt. Washington Auto Road.

While at the summit weather station, teachers were able to shadow staff members and learn about the work of the Observatory. Instructors took their own weather measurements and ultimately shared their experiences with their students by video conference and back at school.

Interested educators can find more information about the program through the Observatory's website, mountwashingron.org.





By making a bubble (1) and going outside (2), students were ultimately learning about ice crystal formation and temperature (3).

Marty Engstrom Receives Challenge Coin During Science in the Mountains Presentation

For some 38 years the bow-tied Marty Engstrom delighted television viewers across Maine and New Hampshire with his thick Maine accent, deadpan delivery and wide grin concluding his weather forecasts broadcast from the Mount Washington summit.

An engineer for Portland, Maine's WMTW, the Fryeburg native achieved a cult-like status.

Engstrom visited the Weather Discovery Center August 7, 2019 as part of the 12th annual Science in the Mountains lecture series delighting a packed house with his tales from living and working on the mountain.

Executive Director Sharon Schilling (l) presents a President's 6310' Challenge Coin and certificate to Marty Engstrom in August.

"Marty on the Mountain" as he was known was also awarded a President's 6310' Challenge Coin and certificate from Executive Director Sharon Schilling in appreciation of his "decades-long dedication to weather reporting from atop the highest peak in New England."

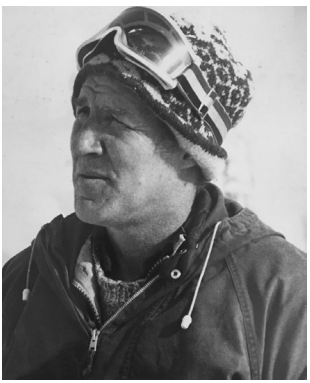
And yes, Marty the summit cat is named after Engstrom.

The popular annual series with various topics pertaining to weather and science will return this summer.

John Burnham Howe 1926-2020

John Burnham Howe, 93, of Jackson, N.H., has completed his final hike. He died January 20, 2020, after a long and vibrant life.

Born in Boston July 8, 1926, he attended Deerfield Academy and Princeton University, and, in 1945, served briefly in the Army Air Corps. His varied career was primarily in geology and meteorological sciences. In the early '60s he worked with NASA on the first generation of weather satellites, Tiros 1. During this time, he lived in Fairbanks, Alaska with his wife, Mary.



John Burnham Howe

As a young man, John worked for the Appalachian Mountain Club, skinning mules, packing loads up to the Lakes of the Clouds and Madison huts, and working as a hutman. He was a member of the Old Hutman's Association. Beginning in the 1950s, his love of hiking led to a tradition on the Summer Solstice, of hiking from Randolph to Bartlett, covering the entire Presidential Range in one day. He continued this ritual well into his 70s.

John worked for many years at the Mount Washington Observatory, serving as staff engineer, scientist, and weather observer, earning the title of "Icingologist" for his expertise in deciphering the vagaries of ice accumulation at altitude. He was known as the Old Man on the Mountain. While working at the Observatory he made many of his shift changes on foot and skis, when weather allowed—and sometimes when it didn't.

One of John's 15 minutes of fame came when he was a contestant on the long-running game show, To Tell The Truth. He appeared as himself, a Mount Washington weather observer. He did not stump the panel, his sturdy Yankee persona was impossible to disguise.

After retiring, John and Mary sailed their 31-foot wooden sloop, Vixen, from Maine to the Bahamas several times. Back in New England, when not at their home in Jackson, they sailed the coast of Maine, where they had many adventures with friends and family. While John would have demurred, his four children's love of hiking, sailing, the natural world, good writing, music and a well-spun tale were shaped by his examples and tutelage. His long marriage with Mary

proved a fine mix of adventure and domestic homesteading comedy that made it seem archetypal.

While fly-fishing, hiking, tinkering with old Volvos and even older clocks abated in the last several years of his life, John was still cutting and splitting his own firewood until just a few years ago. Recently he was still reading Horatio Hornblower and Patrick O'Brian; and listening to Brahms, Handel, Hayden and Mozart.

His sister, Elizabeth Howe Verrill, and his brother, Nicholas, predeceased John. His beloved wife of 58 years, Mary, died just 6 weeks before he did. John leaves behind son Andrew Howe and his wife Gay, of Jackson; son, Nathaniel Howe and his wife Pamela, of Belfast, Maine; daughter Catherine (Cuppy) and her husband Dick Gordon, of Wellesley, Massachusetts; daughter Lucy and her husband Reese Hersey, of East Calais, Vermont. He also leaves behind 7 grandchildren, Whitney and Spencer Howe; Molly Howe and her husband Jake Newton; John (Gus), Charlie, and Sam Gordon; and Ogden (Noggo) Hersey. The family will have a private ceremony in the spring. Donations in John's name can be made to the Mount Washington Observatory, P. O. Box 2310, North Conway, NH 03860.

Staying Warm in Regal Form

TRANSLATED BY **AJ GRIMES**

Greetings from the summit of Meownt Washington! Now that we are in the throes of winter which goes well into spring, I have been staying inside and keeping busy with my rigorous schedule of napping and snacking. Weather Observers insist on venturing outside every hour, but I purr-sonally think their time would be better spent paying attention to me. After all, what's better on a cold blustery day than a warm cat?

Christmas was a few months ago, and Santa Claws was very good to me because I was a good, cool cat last year. I've delighted in playing with my new toys and collecting belly rubs from the humans while lounging in my new cat bed. It's a little less glamorous, but I'm especially grateful for a fresh supply of my favorite litter. That's how you keep a cat happy.

The most interesting occurrence this past winter was a brief encounter with another furry four-legged creature on the summit—one of the State Park rangers brought his dog for a visit (after my approval, of course). It was a little ruff at first, but we sniffed each other through the door, chatted for a bit, and then returned to our usual routines. I don't mind sharing my kingdom with other animals, as long as they recognize who's the boss. Of course, that boss is me which I'm sure I didn't have to tell you!

With a nice stretch to go before mild weather returns to the summit, I'll stay parked on the back of the couch while looking forward to stretching my paws on the observation deck when the sun shines and snow melts. Until next time!

MWO Makes Strong Showing at 100th Annual Meeting of the American Meteorological Society in Boston

BY **DR. ERIC KELSEY** AND **BRIAN FITZGERALD**

The main exhibit hall where MWO's exhibit booth was featured throughout the week of the conference.

From Saturday, January 11 thru Thursday, January 16 Mount Washington Observatory (MWO) staff brought the "Home of the World's Worst Weather" to the 100th Annual Meeting of the American Meteorological Society (AMS) at the Boston Convention and Exhibition Center. AMS's annual meeting brought together scientists, broadcasters, students and other weather lovers and professionals to network and learn from one another with 755 sessions, 2,792 oral presentations, 1,562 poster presentations and 21,000-plus square feet of exhibit space available. For Mount Washington Observatory, the 100th Annual Meeting of AMS represented a significant opportunity to connect with colleagues throughout the weather, water and climate communities from throughout the country right in our backyard.

From a historical perspective, MWO and AMS share a strong link with AMS's founder Dr. Charles Franklin Brooks, who in addition to being a Professor of Meteorology at Harvard University and Director of Blue Hill Observatory, was also considered to be a significant leader in MWO's founding later in 1932. If it weren't for Dr. Brooks' generous donation of meteorological instrumentation, training for new observers and leadership over the

first few years, the reoccupation of Mount Washington may have never come to fruition.

Mount Washington Observatory had its largest involvement at an AMS Annual Meeting ever, which included seeking new interns,

Above: Executive Director Sharon Schilling talks up the Observatory.

Left: Director of Science & Education Brian Fitzgerald explains some of the instrumentation to Boy Scout troops.

and Scouting troops were among hundreds of people streaming through a Westin Hotel function room learning about weather from the full spectrum of weather-related organizations across the country. Visitors of all ages interacted with instrumentation provided by Comptus Inc., a New Hampshire based instrumentation company, including a tipping bucket rain gauge and 3-cup anemometer. MWO staff educated visitors of how weather observations are taken, MWO's mission and work, and why the weather is so extreme on a relatively small mountain. Weather Observer Tom Padham connected from the summit to talk about current weather conditions and the important responsibilities of the observers.

The biggest new splash that MWO made was at the Exhibition Hall. For the

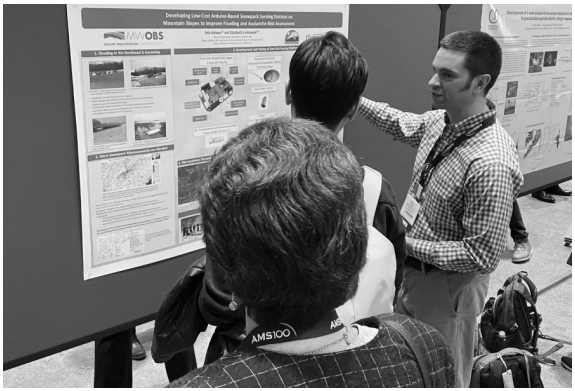
educating the public about what we do, sharing our research and educational programs, and networking for new research and product testing opportunities. Activities kicked-off Saturday and Sunday evenings with tabling at the annual Career Fair. We spoke with dozens of meteorology students and recent graduates about intern and job opportunities with MWO. We've tabled at the Career Fair for eight years in a row now, and often first meet our interns that way. The face-to-face interaction is valuable to answer student questions and for both parties to see if they could be a good fit for the internship.

For the first time, MWO tabled at the AMS public outreach event called WeatherFest. Local children, educators,

Weathers Observers (l-r) Jay Broccolo, Ian Bailey and Director of Science & Education Brian Fitzgerald were ready to answer questions about the Observatory.

first time, we staged an exhibit booth to get the word out to the atmospheric science community about our mission (observations and forecasting, research, education), to network, and create new collaborations with other businesses, such as instrumentation companies and academic institutions, for research and product testing. We used the venue to showcase our "Heated Number 2" anemometer that recorded the world record 231 mph wind speed back on April 12, 1934 alongside a replica of our current pitot static tube anemometer and a model of the new NextGen anemometer being tested on the summit. A TV screen showed current summit conditions and live shots from the summit. Our staff connected with hundreds of people and will be following up with several of them for possible research and product testing collaborations.

Lastly, three MWO staff gave presentations. Director of Science & Education Brian Fitzgerald presented about our education and outreach programs at the Education conference. Information Systems Administrator Keith Garrett gave a presentation about our mesonet, including the instrumentation, maintenance, telemetry and valuable data it provides to support our Higher Summits forecasts and National Weather Service forecasts. Lead Research Scientist Dr. Eric Kelsey presented a poster about the low-cost technology he is using in his snowpack research project. Each of them received good feedback and several questions from scientists looking to learn from us and potentially collaborate. Executive Director Sharon Schilling, Summit Operations Manager Rebecca Scholand and Weather Observers Ian Bailey and Jay Broccolo also provided their insights during the entire event.



Lead Research Scientist Dr. Eric Kelsey discusses his poster about the low-cost technology he is using in his snowpack sensing platforms on Mount Washington.

Many new connections were made and more existing connections were strengthened by our presence at the AMS Annual Meeting. We will continue our advising of Campbell Scientific Inc. and National Geographic's efforts to install and maintain robust instrumentation along the climbing route up Mount Everest. We will explore ways to fund the study of snowpack characteristics with the Cold Regions Research and Engineering Laboratory (CRREL, Hanover, N.H.). Funding for a new research project to study cloud droplet size distributions at Mount Washington during icing conditions will be sought in collaboration with scientists at the National Center for Atmospheric Research (NCAR, Boulder, Colo.). Many more collaborative ideas were discussed and while not all of them will come to fruition, we will pursue them and focus efforts where the greatest opportunities to support our mission and advance atmospheric science are found.

Building on the success of educational programs, such as internships, REUs (Research Experiences for Undergraduates) and Distance Learning programs for students at the undergraduate level, MWO was able to connect with several potential new program partners looking to bring the "real-world" science and operations of MWO into the classroom environment. At the K-12 level, a number of teachers showed interest in MWO's Arctic Wednesdays professional development program. We are working post-meeting with these new contacts to captivate and educate a larger and broader audience with our exciting weather and climate education programming.

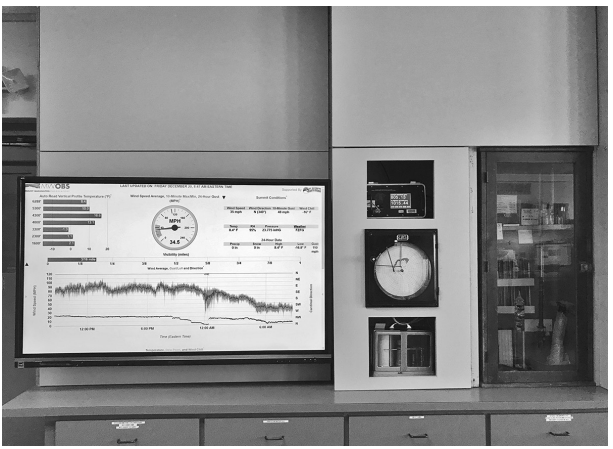
All in all, MWO's participation at the 100th Annual Meeting of AMS represented more than six months of planning and preparation involving either the direct or indirect support of nearly half of our staff. From writing abstracts, to building out our exhibit booth, to fundraising and accounting for the roughly $17,000 budget needed to send our staff, it took many helping hands to make MWO's participation possible. The staff of MWO are deeply indebted to those members who gave so generously to cover portions of this conference budget, and we look forward to sharing the fruits of our labor this year. As we look ahead to January 2021 and the AMS conference shifting to New Orleans, MWO hopes to have another strong showing as time, airfare and budgets allow!

Lead Research Scientist Dr. Eric Kelsey and Director of Science & Education Brian Fitzgerald were among the 1,562 poster presentations at the meeting.

New Weather Wall Streamlines Summit Station

BY **MARTY BASCH**

A new weather wall located in the Jack Middleton Weather Room of the summit weather research station will provide added content and features to educational programs, tours, and media appearances.



Finishing touches still have to be put on the weather wall.

Installed in late 2019, the streamlined wall replaces one that was more than 20 years old.

"In general the new weather wall will have many more uses now than it previously did," said Summit Operations Manager Rebecca Scholand. "Weather Observers can now use it as an interactive centerpiece to all the work they do. Guests of the Observatory will also benefit from having more information easily shared with them."

The new weather wall makes more efficient use of the limited space on the summit. It keeps important and frequently used instrumentation while also making room for new technology by re-arranging and removing items no longer in use.

The old weather wall was a summit fixture for more than 20 years.

The wall, readily seen during summit editions of Facebook Live and

when staff interact with news organizations during broadcasts, contains an indoor barograph, Hays Chart, precision digital barometer and huge touch screen television.

It also has informational graphics detailing extreme summit weather events.

The crews are all smiles during the project. From left to right, Jay Broccolo, Lowell Clarke, Todd Niemaszyk, Mike Connell, Adam Gill, and Ian Bailey.

The barograph is an ink and paper chart that records the indoor pressure on a four-day period while the Hays Chart is also an ink and paper chart but it tallies the wind speed on a daily basis. The colorful Hays Chart is typically associated with high gusts. The barometer provides a digital read out of real time pressure.

Facebook Lives have been remastered while the Weather Discovery Center's "Live from the Rockpile" has become more dynamic and interactive. The same will hold true for Distance Learning programs and EduTrips.

"This will make virtual field trips to Mount Washington in winter all the more exciting for kids in the classroom, and allow for even more dynamic and interesting EduTrips," says Weather Observer and Meteorologist/Education Specialist Ian Bailey.

The interactive touch screen TV revolutionizes how the Observatory gives educational programs and tours.

"Tours will now be able to interact with the station in a new way—having access to current summit conditions, deck cams, satellite and radar feeds, model runs, and more at the touch of a fingertip," says Bailey. "The beautiful display will show any information a tour member could ask in high quality."

The wall, an ongoing project for a few years, replaces one that was completed in July of 1998 built by D.F. Dick Sr. and P.S. Dick of Wrentham, Mass. Some of the instruments on that wall had been taken out of service.

"As new technology has come along it allowed for digital recording to our databases," said Scholand. "Based on time and our need to improve our look to the public a face lift was needed. Further technology could also be implemented to help with educational programs. The new wall was designed to have a more streamlined look as well as showcase our instruments better based on the times."

According to Scholand, the original framework behind the face of the

Weather Observer Tom Padham uses the new weather wall for an educational program.

wall was preserved and strengthened to accommodate the massive 65" touchscreen television. All face panels were newly built and laminated. Thoughtful mounting of the panels allows for easy access to instruments and wiring behind the face of the wall. Remaining instruments were consolidated and given new homes to give the wall a modern look. The wall took roughly three days to be deconstructed, rearranged and built.

Several generous sponsors and supporters made this new weather wall possible which included donations made by Peter Goodwin and Trustee Brad Griswold. Material, construction and labor were donated by Atlantic Construction Group comprised of owner Todd Niemaszyk, and master carpenters Mike Connell and Lowell Clarke.

As for the old instruments from the previous wall, they left the summit but are still with the Observatory.

"If they have been phased out of use or a new system has replaced them they have been brought to the Weather Discovery Center for storage," Scholand said.

Bailey says the new touchscreen provides added benefits, the large display on which any source of data, model, or view can be shown in high quality detail.

"Forecasting Observers can pull up data, graphs, model runs and satellite/radar feeds to help build their forecast, and can take notes and identify areas of interest with annotations to better visualize the data in front of them, he said. "When questions arise about weather patterns and occurrences, a group discussion can be done on the display with ease, and the lead can draw diagrams, graphs, shapes and more to help answer any questions and educate the group."

Don't worry though. Staff will still get excited by the paper Hays Chart on high wind days.

"Observers still run to the Hays Chart to check a high wind gust, record and monitor pressure with the various barometers and charts, and check the digital displays before walking upstairs for an observation," says Bailey.

Marty Basch has been the editor of Windswept for more than a dozen years.

The Butterfly that Braves the World's Worst Weather

BY **SAMANTHA DERRENBACHER**

If you saw a young woman last summer with a large, white, butterfly net hiking around the alpine zone of the White Mountains, that was me. My name is Samantha Derrenbacher and I am one of the New Hampshire Fish and Game employees researching the Granite State's bravest butterfly—the White Mountain fritillary.

The cold-adapted White Mountain fritillary is a glacial relict—part of a barren tundra community left behind and isolated like an island after the glaciers receded approximately 13,000 years ago. It lives only in the alpine zone of the Presidential Range in the White Mountain National Forest—a very specific area that is less than 4.3 square miles. Along with hikers, skiers, and climbers, the White Mountain fritillary spends its daily life braving some of the world's worst weather. Living year round in the cold, windy, cloud-covered alpine zone is tough and the species that survive there have incredible adaptations similar to those found in other barren tundra regions. For example, many of the plants in the alpine zone grow low to the ground or in cushion mats to avoid damage from wind, have protection under snowpack, and absorb and retain heat. Only in protected, concave pockets will you find vegetation that can grow taller with broader leaves. Like these other species, the White Mountain fritillary adapted to the harsh mountain climate and our goal is to figure out in what ways.

Samantha Derrenbacher gets a close up of the butterflies. Photo by Joe Klementovich.

The White Mountain fritillary butterfly lives high in the alpine zone of the Presidential Range. Photos by Samantha Derrenbacher/NH Fish and Game.

The White Mountain fritillary was discovered in the late 1880s by

entomologist and Appalachian Mountain Club co-founder Samuel Scudder. The butterfly was soon largely forgotten until the early 2000s when Kent McFarland, with the Vermont Center for Ecostudies, became interested in the rare species and estimated a population of over a thousand in the Presidential Range. Since then, recreational and environmental impacts have increased in the alpine zone so NHFG has become involved. With a grant from the U.S. Fish and Wildlife Service, Wildlife Biologist Heidi Holman began the White Mountain fritillary project in 2018. The project includes a formal population survey in the Presidential Range and captive rearing study on the summit of Mount. Washington. For the past two summers, the project has partnered with the Mount Washington Observatory to create a temporary captive rearing lab within its summit weather station. Having an indoor working space with mile-high electricity that we can use to provide the right climate for butterflies, eggs and larvae is critical for our research.

Bright orange and black patterned, the adult butterfly is small, with a wingspan that is a little over an inch wide. Adult females lay tiny, intricate, orange eggs. These eggs hatch into tan, hairy caterpillars the size of a 12 point font letter "i". When they hatch, they are first instar larvae and, as they feed, they will grow and molt into a series of 3-5 instars. In the summer of 2018, we determined that the freshly hatched caterpillars do not feed before going into hibernation for the winter. With productive research this past summer, our goal is to overwinter caterpillars we hatched to determine what plant or plants they feed on, how large they grow, and how they form their chrysalis. With a short growing season and regular poor weather conditions, we believe it can take up to two years before the White Mountain fritillary completes one life cycle. To put that into perspective, the Monarch butterfly has four generations in just one year.

Each day working with the White Mountain fritillary is different. The ability to see adults in flight is 100 percent dependent on the weather and, as many outdoor enthusiasts know, the weather on Mount Washington rarely is above 55°F, blowing less than 12 mph and sunny at the exact moment. Therefore each morning, along with many other prepared hikers, I open the Mount Washington Observatory Higher Summits Forecast and webcams to plan the day's goals. On clear weather days, we are trekking upwards of 13 miles anywhere between Mounts Eisenhower and Madison counting and/or collecting butterflies. On cloudy or stormy days, we are driving up the Mt. Washington Auto Road to count eggs and take

A female White Mountain fritillary rests on the trail. The females have a band of white spots along their wings outer edges while the males have yellow-orange spots.

Above left: The small White Mountain fritillary can be found in pockets of vegetation around the alpine zone. Above right: when the butterflies hatch, they are first instar larvae.

care of hatched larvae in our summer lab on the summit.

In the lab, we are attempting to raise a butterfly that we know very little about, which presents challenges in itself. Our research group has over 20 years of experience researching and raising endangered butterflies in captivity in the Concord Pine Barrens, but each butterfly has different needs and different techniques for survival. For example, the Karner blue butterfly hibernates over the winters as an egg, the frosted elfin butterfly overwinters as a chrysalis, and our White Mountain fritillary overwinters twice as caterpillars. With each life stage having unique requirements, we have adapted our techniques to their behaviors and what they need to survive. Over the past two summers of research, we have learned exponentially more than we did before. Our lab has successfully reared eggs into caterpillars, documenting the first of each ever seen in history, as well as mapped flight, egg laying, and mating behaviors of the adult butterfly. In general, we know more about where to look for them and what conditions they are active in than anyone ever has before. Our research has also determined the key morphological difference between White Mountain fritillary males and females—females have a band of white spots along the outer edge of their wings; males have yellow-orange spots.

With increasing climate and recreation impacts, researchers are concerned with the conservation of New Hampshire's alpine zone and the diverse and rare species that live there. The White Mountain fritillary, although a small insect, is part of that unique, diverse ecosystem. It is a fragile species that is sensitive to change; therefore the disappearance of it would indicate a larger change in the alpine ecosystem. In essence, the White Mountain fritillary is our "canary in the coal mine," acting as an indicator species for broad scale environmental changes. If we begin to note a decline in the population with our research, we know that the beauty and diversity of the alpine ecosystem could be lost. At that point, action should be taken to avoid the loss. The project is currently funded by the U.S. Fish and Wildlife Service and donations made to the NHFG Nongame Program. We encourage outdoor enthusiasts to donate to our project, as well as participate by staying on trail, documenting any sightings of the White Mountain fritillary, and sending us your findings. For more information, feel free to check out our Nongame website at www.wildlife.state.nh.us.

New Hampshire Fish and Game Biological Aide Samantha Derrenbacher is focused on researching the White Mountain fritillary butterfly while also assisting in the research of additional state threatened and endangered wildlife.

Clouds Make Big Waves

BY **BILL OFSIANY**

You would think that a clear sky, and one hundred and twenty mile visibility would be the ingredients for a great sunrise. A great sunrise needs more than that. Clouds are needed, from the horizon to directly overhead, to catch the early rays from the sun even before it comes above the horizon. These high clouds reflect and refract the sunlight, illuminating them from within, and producing the breath-taking sunrises you get to see when you spend time on the summit.

Sometimes there are conditions that make a sunrise not the most impressive event occurring that morning. It wasn't the sunrise that made this particular day special. There were no clouds from the horizon to overhead when the sun came up, so the sunrise was a red orb rising into a clear sky. The clouds were filling the valleys below, with only the sunlit summits sticking up above the clouds. The weather forecasters call these stratus clouds. They produce a condition known as undercast. The undercast had retreated down the mountain from the day before, when only Mount Washington stuck up in the sunshine and the rest of the area was hidden from view by the clouds below. On this second day, the cloud tops were at a level that allowed some of the higher peaks to stick out above the undercast. Looking east from the Mount Washington summit, the view looked more like a series of islands somewhere along the coast of Maine on a stormy day. The high summits were the islands, and the layer of undercast that surrounded them was the ocean. The rows of wave-like clouds, like ocean swells, lined up one behind the other, and stretched out as far as you could see.

Over what would be the town of Jackson, the top of the cloud wave rose up into the shape of a breaking wave as it neared the southwest slope of Wildcat Ridge sticking out of the clouds. Like sets of waves on the ocean, the one closest to land was building up in height as the ground underneath came up, and the wave rose vertically until it couldn't support itself, and came crashing down. The rows of waves behind had not yet reached this point of instability and just fell in behind the breaker.

Pinkham Notch was awash with turbulence as the breakers fell apart and splashed up the sides of the ski area almost to the top of the ridge. The breaking waves not only poured through Pinkham Notch but were also washing over through Carter Notch between Wildcat Ridge and the Carter-Moriah Range. Near the base of the Wildcat ski area, standing waves had formed, going straight up, until

Clouds can turn a mountainous scene into an image more like the rugged coast of Maine.

gravity pulled them back down into the turbulence. Still further to the northeast, looking past Nelson Crag, the clouds were setting up into short period waves with steep faces like the ones that form when deep ocean swells encounter shallow water. The distance between the crests got shorter. The stop-action of the clouds was showing the fluid dynamics of what was happening below. It was the same laws of physics doing to the clouds below the summit what is done to waves on the ocean or any flowing water. The only difference was the density of the medium.

The view to the southwest from the summit presented a different atmospheric flow over the Southern Presidentials. Only Mount Monroe and Mount Franklin were above the clouds while Eisenhower, Pierce, and Jackson were buried in the undercast. Waves flowing through the Monroe col and the depression between Monroe and Franklin were pouring over the ridge and flowing down toward Marshfield Station far below. Far to the west, Franconia Ridge stood above the clouds like yet another far off island in a sea of clouds.

The next day the undercast had lowered even more, revealing many more islands and even a coastline, drying out the tempest in Pinkham Notch, and revealing the hills around Jackson that caused the formation of breakers the day before. This day was not stormy, but a serene, low tide morning by the coast. It was a totally different morning, one with a sunrise that was more spectacular than the undercast below.

An Observatory member since the late 1960's, Bill Ofsiany regularly keeps a journal when he volunteers at the summit. He is a retired teacher.

Environmental Education in the Home of the World's Worst Weather

BY **WILL BROUSSARD**

Winter came in early November with an arctic blast followed by relatively average temperatures for much of December. As we transitioned into 2020, we received an early January thaw in the form of spring-like temperatures throughout the region. This did not last as a polar outbreak took hold for the second half of January and coincided with our first educational summit trips of the year. Released in August to much fanfare, the majority of EduTrips sold out by September. We were excited to offer a new program in 2020 called, "Stories from the Mountain: Risk and Decisions in Wild Weather" led by local author Ty Gagne. Other themes included the very popular Science of Winter Storms, Winter Mountaineering Essentials, Weather Basics, and Climate Research in the White Mountains. Once again we partnered with Eastern Mountain Sports Climbing School, Synnott Mountain Guides and Mooney Mountain Guides to provide a unique lodging and educational experience for visitors hiking to the summit.

Returning for its fourth year, Arctic Wednesdays Professional Development for Teachers in Extreme Weather and Climate took place on select shift change Wednesdays in January, February and March. Following a pilot program in 2017 focusing on Mount Washington Valley, this year's cohort of teachers hailed from Plymouth, Manchester, Dover, Stratham, Conway, Lyme, Laconia and Windham in New Hampshire; Falmouth and East Waterboro in Maine; and Dracut in Massachusetts. The Arctic Wednesdays program continues to provide essential professional development and curriculum-enhancing opportunities for teachers from throughout New England giving them a chance to collect data in the extreme alpine environment alongside weather observers and report their findings live to the classroom. Know a teacher who might be interested in this opportunity? Encourage them to sign up for our fifth season in 2021!

The mission of the Education Department mirrors that of the Observatory as a whole, which is to advance understanding of the natural systems that create Earth's weather and climate. As a team we serve this mission by communicating the work of the weather observers stationed at the summit year-round, the research they and others at the Observatory conduct on weather and climate, and through the interpretation of the natural, cultural, and scientific heritage of the Mount Washington region. Interested in hosting a program at your nearby school or community center? Please visit Mountwashington.org/educational-programs or call 1-800-706-0432 ext. 211 for more information.

Summer/Fall 2019 Weather Data

	AUG.	SEPT.	OCT.	NOV.
Temperature (°F)				
Average	47.8	41.6	34.9	16.2
Departure	-0.3	0.0	+4.7	-4.5
Maximum	60	57	55	52***
Date(s)	7th, 20th	20th, 28th	1st	1st
Minimum	33	29	16	-17
Date(s)	31st	17th, 18th	4th	13th
Precipitation (inches)				
Monthly	4.41	8.95	11.58	7.21
Departure	-3.91	+0.92	+2.31	-2.64
24-hour Maximum	1.01	2.23	3.68	1.47
Date(s)	7th/8th, 21st	23rd/24th	1st/2nd	24th/25th
Snowfall (inches)				
Monthly	0.2*	T*	10.5	55.8
Departure	+0.1	-2.2	-7.1	+18.0
24-hour Maximum	0.2*	T*	3.9	12.1
Date(s)	10th	24th	25th/26th**	27th/28th
Season Total	0.2	0.2	10.7	66.5
Departure	+0.1	-2.1	-9.2	+8.8
Wind (mph)				
Average	26.9	31.0	35.5	42.8
Departure	+2.9	+2.4	+0.9	-2.1
Peak Gust/Direction	75 W	89 W	128 E	130 W
Date(s)	11th	4th	17th	1st
Days 73+	2	6	13	17
Days 100+	0	0	4	10
Other				
% Sunshine	44	42	35	32
Clear Days	5	3	4	4
Partly Cloudy Days	7	9	4	4
Cloudy Days	19	18	23	22
Days with Fog	28	29	27	28
Days with Rain	14	18	17	4
Days with Snow	1*	1*	9	24

** Fell as small hail*
*** Last of several occurrences*
**** Monthly record high of 52°F equaled; record originally set on November 4th 1982*

A Little Bit of Everything

BY **RYAN KNAPP**

For this time frame, the summit sees summer warmth give way to early winter cold. Transition seasons provide nearly every type of weather one can think of, providing a little bit of everything for everyone visiting or working on the mountain.

August 2019

August started in the fog but trended towards clearing as high pressure built in. Fair weather conditions remained with the large ridge through the sixth. A cold front brought rain and thunderstorms on the seventh with an upper level low keeping wet weather going into the eighth. Another cold front brought another round of thunderstorms for the ninth/tenth and it was cold enough aloft for hail and sleet to fall and briefly accumulate. A weak disturbance provided rain and drizzle on the eleventh. A stalled front to the west kept conditions cloudy/foggy on the twelfth/thirteenth then provided light showers as it passed late on the thirteenth. Despite some added clouds overhead, fair weather conditions returned on the fourteenth/fifteenth.

A passing low on the sixteenth/seventeenth provided rain showers for both days and thunderstorms late on the seventeenth. Warm and muggy conditions set up on the eighteenth/nineteenth as a Bermuda High set up offshore. A few showers occurred on the eighteenth/nineteenth with drier conditions briefly setting up on the twentieth. Heavy rain and thunderstorms traversed the region on the twenty-first/twenty-second as a cold front swept through. Fall-like weather returned on the twenty-third/twenty-fourth as a northwesterly flow with a building ridge set up behind the frontal passage. Milder temperatures and fair weather skies returned on the twenty-fifth as the ridge crested and slid east through the twenty-seventh. The remnants of a tropical storm moved up the coast on the twenty-eighth and provided periods of moderate to heavy rain with its passage through the twenty-ninth. High pressure built for the thirtieth providing fair weather conditions. Weak disturbances passing by the state ended the month with clouds on and above the summits.

September 2019

High pressure started the month with clear skies and seasonable conditions. A cold front returned fog and heavy rainfall on the second with some parts of the White Mountains receiving nearly 3 inches of precipitation. The third saw high pressure briefly crest with fair weather as another strong cold front on the fourth brought another round of rain and scattered thunderstorms. Rain and drizzle lingered

into the fifth then tapered as cold air plunged in and provided the first icing of the season. Fair weather returned on the sixth but gave way to fog and upslope showers on the seventh/eighth. High pressure brought fair weather conditions for the ninth and into the early hours of the tenth when a warm front swung in returning clouds and rain for the overnight hours. Rain remained on the eleventh, falling heavy at times as a cold front passed. Upslope rain showers lingered early on the twelfth then trended towards clearing as high pressure built and lingered into the thirteenth. A passing trough on the fourteenth provided light rain showers, which would linger until early on the fifteenth.

Upslope showers lingered on the sixteenth and light glaze ice formed. High pressure built in on the seventeenth to keep conditions cool with fair skies but as the ridge slid east then remained anchored offshore, a return flow warmed temperatures to slightly above average by the twenty-first. Fair and mild conditions lingered on the twenty-second as the ridge started to depart and a low approached for the twenty-third. The passing low on the twenty-third provided thunderstorms and heavy rain with nearly 2 inches falling. Upslope showers lingered on the twenty-fourth tapering to drizzle on the twenty-fifth. Fair skies briefly worked in early on the twenty-sixth but fog and rain returned by the afternoon as a cold front passed. Drier air worked in on the twenty-seventh but would give way to a warm front and cold front on the twenty-eighth/twenty-ninth. High pressure ended the month with clear but cold conditions.

October 2019

A warm front started the month with heavy rainfall dumping just over 3 inches of rain. A trailing cold front would bring another inch of rain as it passed on the second. Fair skies early on the third gave way to a wintry mix overnight into the fourth as a low passed from the west. High pressure on the fifth/sixth gave way to a cold front on the sixth/seventh providing periods of heavy rainfall. High pressure built in on the eighth then remained over the region until the tenth. A coastal low finally moved north on the eleventh providing light rain showers. The remnants of a sub-tropical low provided additional light showers on the twelfth. High pressure set up offshore for the thirteenth through the fifteenth.

A strong low set up on the sixteenth and delivered a wintry mix that eventually turned to rain on the seventeenth then back to snow on the eighteenth. All three days saw gusts exceeding 100 mph. Snow showers lingered behind the exiting low on the nineteenth as winds finally started to decrease. High pressure briefly crested on the twentieth but gave way to a coastal low overnight. Fair weather returned on the twenty-first/twenty-second but a warm front returned rain by the overnight hours. A cold front continued rainfall for the twenty-third followed by a wintry mix on the twenty-fourth as a weak low traversed the international border. A cold front on the twenty-fifth/twenty-sixth brought light snow showers with its passage. High pressure on the twenty-sixth gave way to a low from the Ohio River Valley, which provided snow that transitioned to moderate freezing rain and a touch

of rain on the twenty-seventh. High pressure provided sunshine and warm temperatures for the twenty-eighth/twenty-ninth. A warm front on the thirtieth provided rain and warmth breaking the daily record high on the thirty-first.

November 2019

Rain and warmth continued into November as a high of 52°F on the first tied the monthly record high. As a strong cold front passed late in the day, temperatures plunged into the teens and snow returned along with gusts of 130 mph. High pressure provided cold but clearing conditions for the second. Bands of moisture from the Great Lakes provided snow on the third/fourth. A warm front on the fifth provided additional light snow showers. Upslope showers lingered into the morning of the sixth with clearing later. A Great Lakes low dragged a cold front through on the seventh/eighth followed by persistent upslope snow showers until early on the ninth. High pressure quickly passed on the tenth followed by a cold front for the tenth/eleventh. A warm front on the eleventh/twelfth brought a wintry mix followed by snow with an Arctic front the twelfth/thirteenth. Cold air that followed set two new daily record lows as temperatures dropped to 17°F below. A Clipper brought snow and a few squalls the fourteenth/fifteenth.

High pressure provided dry conditions the sixteenth/seventeenth. A coastal low provided mixed precipitation on the eighteenth and then tapered to snow on the nineteenth. Another coastal low brought another quick round of snow on the twentieth. Fair skies early on the twenty-first gave way to clouds later as a warm front swung northeast for the twenty-second followed by a cold front and high winds overnight. High pressure on the twenty-third gave way to a nor'easter along the coast on the twenty-fourth/twenty-fifth leaving nearly a foot of new snow by the time it departed. High pressure provided fair weather on the twenty-fifth followed by another strong low from the Great Lakes for the twenty-seventh/twenty-eighth. This storm brought another foot of new snow and even some thunderstorms. Canadian high pressure on the twenty-ninth/thirtieth provided fair skies overhead and undercast conditions below.

6:30 PM Fri. Aug. 2, 2019

Now that July is over, let's look at how this July stacked up in our records.

First, looking at temperatures, the average temperature for this July was 52.4°F, which is 3.4 degrees above our average of 49°F. For up here, that is quite a bit above average since our summer months usually do not see much variation in temperature from year to year.

2019 ended up being our seventh warmest July on record. What is unusual about this month being a top 10 warmest month is the fact that we set no daily record highs. Where this year got its warm average was very warm overnight lows. The lowest temperature that we saw this month was 41°F, which is the warmest lowest monthly temperature we have ever seen in our history. The previous highest was 40°F in July of 1955.

Next up is precipitation. July had quite a few days with measurable precipitation but no days with an insane amount. We were a little above average in days with measurable precipitation but our highest amount we saw in 24 hours was only about 1.69 inches. Most months we will see at least 2 inches in a 24-hour period either due to a tropical system passing nearby or training thunderstorms over the White Mountains. Our total precipitation was 7.72, which is 1.05 inches below normal. July ended up being the 32nd wettest July on record.

As far as wind speed goes, we averaged 25.6 mph this month, which is -0.1 mph lower than the average of 25.7 mph. This made for the 38th windiest July on record. The highest wind gust was 82 mph on the 14th which is a pretty typical summer time peak monthly wind.

—Adam Gill, Weather Observer & IT Specialist

10:23 AM Wed. Sept. 18, 2019

The next step in ensuring a long future of research-quality wind speed measurements occurred this summer when the next-generation pitot static tube anemometer was disassembled and modified to fix a couple of problems that arose this spring and summer. In the spring when temperatures began to rise above freezing regularly, we noticed occasional spikes in wind speed that looked unrealistic. While we expect the NextGen pitot to measure higher wind gust speeds than Pitot 19 (our operational pitot) because of significantly shorter tubing, some gusts were over 40 mph higher with no sign of a big gust from the Pitot 19.

Given all the data we had, we correctly suspected water was getting into the slip ring, which is located in the top of the mast. When we disassembled the

NextGen pitot in June, our suspicions were confirmed—we found water marks and rust on the inside. Fortunately, all we needed to do was remove the slip ring–problem solved! The purpose of the slip ring was to prevent twisting of wires coming down the mast from the heaters and pressure-transducers. However, this is not a big problem because the wind does not turn over 360 degrees very often—only a few times a year. Observers can easily identify when this has happened, and they can simply go to the top of the parapet and turn the pitot around to unwind the wires. They already do this for the Pitot 19.

After the rewiring was completed, we reinstalled the NextGen pitot on the parapet on August 13th. It has performed terrifically through many rain and high humidity events since then—it appears removing the slip ring worked.

The wind has been moving at its typical late summer snail's pace since the NextGen pitot was reinstalled. But in the last week, sustained winds have reached 60-70 mph a few times. The next real test will be the next time the summit sees strong winds gusting over 100 mph with rain. We have every reason to believe the NextGen pitot will perform flawlessly in any conditions on the summit—and we will eagerly await fall and winter's wrath to put the NextGen pitot to the test. Bring on the wind!

—Dr. Eric Kelsey, Lead Research Scientist

12:14 PM Sun. Oct. 6, 2019

Already in my first week and a half on the summit, I have been lucky enough to experience a wide range of exciting weather phenomena, which has given me a great taste of what is yet to come as fall transitions into winter. The most recent one of which included experiencing rime ice for the first time! This is something I had heard about (and seen lots of pictures of) but seeing it for yourself is quite amazing. When I stepped outside onto the observation deck in the morning, the sun was shining on the snow and ice that encased the summit and it made me feel as though I had stepped into a winter wonderland. I was finally able to see my first glimpse of rime ice!

When clouds envelope the summit and temperatures on the surface are below freezing, rime ice is able to form. When liquid water droplets come in contact with an object, they freeze and

form this beautiful, feather-like type of ice that can build up along any surface (on rocks, the sides of buildings and along railings). Rime ice is typically opaque rather than clear due to the fact that the water droplets are freezing instantaneously upon contact (in spheres that trap little air bubbles). As those individual droplets collide with different surfaces, the ice builds up in the direction that the wind is coming from, so it makes for a very picturesque scene.

From preliminary data, it looks like the occurrence of rime ice this year (on October 5th) was the latest that the summit had experienced its first riming of the season. De-icing the instruments on the top of the tower became necessary as the temperature dropped to 15°F, which was the coldest of the season so far. I'm really glad to have gotten the chance to experience the first rime ice event!

—Laura Kee, Summit Intern

8:30 AM Sat. Nov. 16, 2019

Sometimes we're cooking up a storm up here. I thought I'd write about some of our favorite meals here on the summit and our cooking set-up. I personally enjoy cooking very much, and this time of year it's nice to make use of what we have in our pantry and attempt to make some great meals for the crew. This time of year especially we do tend to favor more hardy, warming meals, although salads and fresh veggies do accompany most dinners.

Some of my go-to favorites to cook up here are pizza and a whole roast chicken. It's fun being able to make pizza dough from scratch in the Observatory's stand mixer, and there are so many different possibilities for toppings. Buffalo chicken is my personal favorite, and it's a little different than the traditional pizza. The secret is the sauce which is all thanks to butter! The sauce is a blend of melted butter and normal cayenne hot sauce, which then cooks into the dough and helps make it crispy and delicious.

Sunday on weeks that we don't have volunteers I often cook a whole roast chicken, which is really a pretty simple, but comforting meal. A 3 or 4 pound chicken is pretty perfect for the four of us up here on these weeks, and it normally only takes about 90 minutes in an oven at 425°F. I've tried doing more fancy or extravagant dressings for the chicken but plain with just some kosher salt and pepper turns out really good and is usually the one we do most often. Sides with this are often mashed potatoes and stuffing, so it's almost like a mini-Thanksgiving! Definitely a great meal to unwind with after a long day, and Sundays tend to be a bit more of a relaxed day up here in terms of work load which lends to having a bit more time in the kitchen to prepare for the feast!

We also try some new things. These past few shifts I've attempted using the slow cooker a bit more, and found a great recipe for sesame orange chicken that turned out really great! Corn starch in the sauce aided in an almost candy-coating on the chicken with an orange marmalade, and it really turned out pretty similar to what you'd get in a good Chinese restaurant. Another new avenue I've been exploring is pickling vegetables. We sometimes have a surplus of extra veggies on hand towards the end of the week, and instead of letting them go to waste I figured pickling would be a great option. I've tried the classic dill pickles so far, but have also done some mustardy-pickled carrots that turned out good and a garlic-dill batch of radishes, red onion, and cucumber that turned out surprisingly well! We have a great variety of appliances and ingredients here in our kitchen especially if one thinks a bit outside of the box. It's really fun trying experimenting with some new recipes or techniques.

I am admittedly a pretty novice baker, but luckily I'm not the only one doing all the cooking and baking up here. AJ is a great baker, and we all take turns with meals or pitch in for a different dish. Even if cooking isn't your strength or even an interest there's still always setting the table or dishes to be done from the cooking frenzy. Science may be our career and our passion here at the Observatory, but so many of us here have many other talents. Bon appetit!

—Tom Padham, Weather Observer & Education Specialist

Behind the Polar Vortex

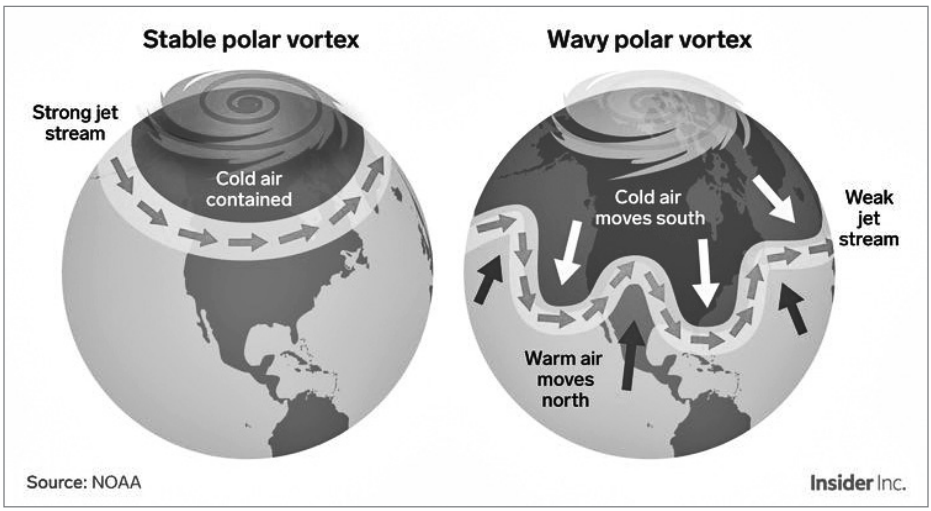
BY IAN BAILEY

What is the polar vortex? And what's involved in leading to a polar vortex event for the United States? You have probably heard about it before listening to the news. And unfortunately, with many broadcasters over-hyping storms in recent years, the term has often been found to have been used incorrectly, leading to confusion.

A polar vortex is a large region of low pressure that swirls over the poles. Under normal atmospheric conditions, the rotation of this large low pressure region creates a jet stream, a high-velocity river of air high up in the atmosphere that flows in a circular path completely around the planet. A jet stream then acts like a boundary between air masses; everything north of a jet stream is generally colder, and everything south of a jet stream is generally warmer, with "warmer" and "colder" being terms relative to where you are located. As such, the air mass that is trapped over the North Pole by the polar jet stream has very cold air associated with it. And when that cold air wanders too far south, that's when we get that buzzword polar vortex event.

So then what leads to a polar vortex event? What would cause the jet stream to dip down into the United States, leading to cold snaps across the country? It may seem counterintuitive, but a strong polar vortex event is related to an overall weaker polar vortex. Under normal conditions, the polar jet stream winds are strong enough to keep the flow relatively circular around the pole, keeping that cold air trapped in the north. The weakening of those winds causes the flow to become less circular, taking a more north-south waving path. When you account for blocking high pressure systems within that path, that north-south flow can become amplified and force that cold air really far south. The intensity of that amplification determines how far south that air will flow, and in turn how intense the polar vortex event will be for various parts of the country.

So what causes the weakening of the vortex? Quite a number of things, and probably a decent number of things we can't even measure or account for yet. There have been recent studies published in the *Bulletin of the American Meteorological Society* and *Nature* that have found that melting sea ice in the Arctic may play a big role. Normally that sea ice can trap heat energy and stop it from being released back into the air, allowing for a greater contrast in temperatures between air masses, and allowing for strong winds. Less sea ice means more heat energy escaping into the atmosphere, less of a contrast



Strong versus weak polar vortex structures and flow patterns. Source: NOAA

in air mass temperatures and weaker polar jet stream winds, allowing cold air to dip south. So that is certainly one piece of the puzzle. However, this can certainly be difficult to predict more than 10 days out, making forecasting for polar vortex events quite difficult.

What about El Niño? Is it related to polar vortex events in any way? Well, it's definitely another piece of the puzzle. El Niño is a fluctuation of warm sea surface temperatures back and forth across the Pacific Ocean. When warmer water lies from the central Pacific to the Americas, that dictates what we call an El Niño weather pattern. And when the warmer water lies further west, near Asia and Australia, that dictates a La Niña weather pattern.

In an El Niño pattern in regards to the U.S., there is increased warming from the Pacific that leads to what we call a sudden stratospheric warming, or an increase in temperatures far up into our atmosphere pushing north to the pole. The effect is similar if not greater than the melting sea ice effect mentioned before, and it greatly promotes the formation of those north-south wave patterns in the jet stream. As such, a weakening of the polar vortex is certainly more likely during a strong El Niño event than in other conditions. Fortunately, we are a bit better at monitoring/predicting El Niño events that allow us to forecast seasonal climates with decent accuracy. But again, it's only one piece of a very complicated puzzle with many pieces we haven't accounted for yet.

Extra Planning Makes the Difference

BY **REBECCA SCHOLAND**

To this day I can confidently say that winters on Mount Washington are my favorite season. This winter marked my fifth winter with the Observatory and although I am not overnighting on the summit as I once had on shift, you can still feel and observe the seasonal change. The hustle and bustle of the New Hampshire State Park's Sherman Adams building has calmed down, but our weather has ramped up on the summit. As fall turns to winter our operational duties within the Observatory increase. Our responsibility to maintaining a safe working environment becomes all too real. Extra clothing and gear is packed each shift not just for the colder temperatures, but in case the weather postpones a shift change. Daily chores become more arduous as shoveling emergency exits is constant and monitoring our weather observational equipment occurs hourly at times. Winter has a cold hard bite on the summit and keeps everyone on their toes.

Transportation is another aspect of the winter season that is beyond unique. While the summers offer a stress free transportation plan and execution, the winter is just the opposite. The planning that goes into a winter shift change alone is awe-inspiring. So many factors need to be considered. What is the forecast for the day, how much snow has fallen, has there been blowing snow, what speed and direction are the winds, what is the visibility, will there be precipitation, what is the temperature? On top of all the questions there is constant communication

There is constant communication and coordination in heading up the Mt. Washington Auto Road.

and coordination with the Mt. Washington Auto Road and New Hampshire State Parks—Mount Washington division. We work in tandem under the Auto Road's direction to ensure the road is in its best state for use. We have even "cat-pooled" at times to reduce the wear on the road when snow is sparse.

Intern Eve Cinquino

Another seasonal change is the return of our veteran volunteers on the summit. As the New Year began so did our DayTrips, EduTrips, Arctic Wednesdays, Partner Led Climbing Trips, and more. Without our dedicated volunteers, providing the hospitality and educational programs to the participants would be near impossible. The work our summit volunteers contribute to a shift week is hard to put into words. It speaks volumes to their dedication, integrating into our work life and schedule one shift at a time.

Staff changes are also experienced. Our fall Interns Ben Charles, and Laura Key finished just before the New Year and Eve Cinquino and Caleb Buchler began. We also had a Winter Break Intern through a partnership program with Plymouth State University. Nicholas Rousseau spent two shifts on the summit working on a research project that he will continue into his spring semester at Plymouth State University with Dr. Eric Kelsey. One of our sadder changes was the departure of Weather Observer Adam Gill to a position within the National Weather Service in Binghamton, New York.

Intern Caleb Buchler

Despite the seasonal changes and implications that harsh weather brings on preparation and execution of summit operations, we will prevail as we always have. The winter on Mount Washington gives us our moniker "Home of the World's Worst Weather" and we thrive in it, with a little extra planning.

Cannon Mesonet Station Gets Great Support

BY **PETE GAGNE**

When I was hired in August of 2010, the mesonet was still expanding under a three year grant in conjunction with our research partners. And we didn't wait for nice summer weather to build new mesonet sites in very remote areas. Ken Rancourt, my boss, mentor, and friend, dragged new equipment up to the Halfway House site at 4500' along the Cog Railway to build my very first station, and then to Cannon Mountain in Franconia Notch for the second. It is this station that I want to write about in this *Windswept* issue.

For anyone who has hiked or skied at Cannon in winter, they know that it exhibits some of the fiercest cold and heaviest icing in the White Mountain National Forest. When I hiked it in mid-January of 2007 in my quest to join the Four Thousand Footer Club, it was so frigid that I did not even remove my balaclava for my summit picture! The icy tower stood silent witness to an eerie, snow-white winter desolation that was somehow alluring.

Our temperature, humidity and barometric pressure sensors are time-proven to stand up to the worst of weather, but traditional wind instruments, such as three-cup and plastic propeller sensors, would never stand up to these challenging conditions. Therefore, a different solution was required in order to measure wind speed and direction here.

We considered using the Observatory's innovative pitot static-tube anemometer like the summit, but the least bit of moisture in the plastic hoses between the pitot and measuring sensor can block the air pressure from reaching the sensor. Our summit weather observers are always on hand to clean out the hoses using specialized equipment and solvents. Cannon would be a remote operated site, so it would be impractical to send a technician out there every time the hoses clogged.

It became clear that the best solution was to use a Taylor Scientific Engineering six-cup aluminum heated anemometer and vane. Cannon has a recorded high wind speed of 199.5 mph in 1973, which at the time was the third highest measured wind speed in the world! So we wanted to ensure that our instrument went at least that high, and the Taylor was up to that task. We calibrated it to record up to 300 mph (just in case!). It was Taylor anemometers that measured a 199 mph wind gust on California's Ward Mountain in 2017.

This anemometer has very high wattage, self-regulated heaters, and

The tower shown in light ice conditions.

The tower encased in heavy ice conditions.

it does not require any intervention. It has been in operation since late 2011 with minimal problems. We did recently replace the wind-direction potentiometer that does the actual measuring, but with the vane constantly spinning 24/7/365 for nine years, I wonder how many cycles it had on it? All I can say is it is surely in the millions.

As one can imagine, even with the maximum available 1,500 watts of heating power that the Taylor can supply, the massive coils can't always keep up with ice accretion rates that approach that of Mount Washington. The two photos with this article show the tower in ice light and heavy. I can attest that the ice makes the first tram ride of the day interesting when the car approaches the docking station. The ice falling off of the guide cables pounds the top of the car like Thor's hammer, and if you aren't used to it, it can be unsettling. This past winter, we also operated a Rosemount ice-detector in order to quantify these perceived icing rates, and look forward to working with Taylor Scientific on evaluating and improving the Taylor heaters.

I write this article focusing on our Taylor anemometer in this issue to highlight one of our many supplier relationships that allow the Observatory to continue our 87-year continuous weather record. Owner Phil Taylor has been such a great supporter of our mission, supplying us with parts, rebuilds, and technical advice. Long-term wind measurement at sites such as Cannon would be difficult, if not impossible, without products such as this, and we couldn't keep it operating without people like Phil Taylor.

Volunteer Services Are Always Appreciated

BY **HANK AND LINDA DRESCH**

The Tuesday mailings are an important part of what volunteers do. In January, a smiling-bunch helped out. Standing (l-r): Bob Deegan, Bill Housum, Floyd Corson, Marietta Deegan, Karen Franke, Linda Denis, Jean Perry, Peter Fisk, Linda Dresch. Seated: Jane Rancourt, Jim Vanasse, Ken Rancourt, Gary MacDonald, Bob Santoro. Missing from photo is Kim Henry.

Spring's arrival is welcomed by many around here. For us, we enjoyed the strange winter weather, particularly some beautiful snowy days in January that helped improve the skiing conditions.

In the middle of fall we gathered at the new Glen House Hotel at the base of the Mt. Washington Auto Road to honor all Observatory volunteers who willingly gave of their time to help in the valley as well as on the summit. Even though many summit volunteers are from away and were not able to attend this event, we do realize their great numbers and their contributions. Chairman Gary MacDonald and Executive Director Sharon Schilling welcomed attendees. The Observatory's Valley Volunteer of the Year for 2019, Marietta Deegan, received her well-deserved recognition. Summit Volunteer of the Year Award went to Charlie and Jeanine Kinney.

The late arrival of winter enabled the

Executive Director Sharon Schilling (l) recognizes Marietta Deegan (l) as Valley Volunteer of the Year.

Weather Discovery grounds to be cleaned and put to bed on a sunny and unusually mild November day. Thanks to Steven Whitaker for organizing this activity, and to Bob Santoro, Peter Crane, Jane and Ken Rancourt, Barbara Althen, Bill Ofsiany, and your Valley Volunteer Coordinators for trimming shrubs out front, along with raking leaves, grinding them to mulch and spreading them on the flowerbeds.

We continue to have our monthly

Membership Mailings at 9 a.m. on the second Tuesday of the month in the Weather Discovery Center located in North Conway. A core group of experienced volunteers come together to get this job done in record time; however, we always welcome anyone who can spare the time to help. Once again, we thank Kim Henry for taking charge of the November mailing while we were in Sicily. Her contributions make us realize how big a gap there is when Kim is absent, and we wish her a speedy recovery from shoulder surgery.

Our thanks to the dedicated volunteers who have been able to help us recently. These most helpful folks include:

Barbara Althen
Peter Crane
Floyd Corson
Marietta & Bob Deegan
Linda Denis
Linda & Hank Dresch
Peter Fisk
Karen Franke
Donna Gray
Kim Henry
Ava Honan
Bill Housum
Marie Kaspar
Gary MacDonald
Bill Ofsiany
Jean Perry
Jane & Ken Rancourt
Bob Santoro
Jim Vanasse

A hard-working crew cleaned up the Weather Discover Center grounds on a mild November day. They were (l-r) Bob Santoro, Peter Crane, Ken Rancourt, Barbara Althen, Jane Rancourt, Bill Ofsiany, Linda Dresch.

Valley Volunteer Coordinators Linda and Hank Dresch can be reached at hankandlinda@mountwashington.org or by phone: 603-356-2137 ext. 208.

20TH ANNUAL SEEK THE PEAK JULY 17-18

Be a part of the Observatory's future by hiking Mount Washington or another peak! Register now to help raise $200,000 to support the Observatory during Seek the Peak in July. The 20th rendition of the nation's premier hiking event is a totally awesome adventure where participants can seek their own peak. Take a shorter guided nature hike with an Observatory staff member. Hike by yourself, with friends or with family. Don't feel like hiking? That's okay, do it virtually. The hike-a-thon is the Observatory's largest annual fundraiser. Each hiker is requested to raise at least $200. In return, participants are rewarded with prizes and entry into drawings for a wealth of prizes. The first 500 hikers to raise the minimum receive a Seek the Peak backpack. The event begins July 17 with registration at the Weather Discovery Center in North Conway where hikers can pick up their backpacks and t-shirts while also enjoying light refreshments, appetizers and socializing with like-minded outdoor enthusiasts during the Kick-Off Party. On July 18, hit the trails and while on the Mount Washington summit, take part in a weather station tour while enjoying some delicious cookies. After your hike, head to the Vendor Expo at the base of the Mt. Washington Auto Road to recount your journey with fellow hikers while also meeting Observatory staff, and the sponsors and partners who make STP possible. Follow that with the After-Party that includes an all-you-can-eat dinner and awards ceremony. Visit seekthepeak.org to sign up.

PARTNER LED CLIMBING TRIPS

Take an overnight mountaineering expedition to the Mount Washington summit. Climbing instruction, overnight summit accommodations at our weather station, behind-the-scenes tours of Extreme Mount Washington and spending time with staff are all part of the package. Contact each guide service directly.

March 27 Overnight climbing trip with Mooney Mountain Guides (mooneymountainguides.com).

April 4 Overnight climbing trip with Synnott Mountain Guides (newhampshireclimbing.com).

BIG WIND DAY APRIL 12

Celebrate the day in 1934 when the Observatory registered the record 231 mph wind gust atop Mount Washington. Visit mountwashington.org for more details.

ANNUAL MEETING IN JUNE

A recap of 2019, the meeting also gives members a chance to meet the staff and trustees. Check mountwashington.org for the specifics and date.

IN KIND DONORS & EVENT SPONSORS

Appalachian Mountain Club
Apple Inc
Attitash Mountain Service Co., Inc
Attitash Mountain Village & Ski Resort
Backpacker Magazine
Backpackers Pantry
Bagels Plus
Bavarian Chocolate Haus
Big Agnes
Big Dave's Bagels
Brothers All Natural
Cabot Creamery
Campbell Scientific
Carol Haney
Cascade Designs, Inc
CGI Business Solutions
Chums
Cranmore Mountain Resort
Cross Insurance Agency
Darn Tough
David J. MacKenzie
Delta Dental
Designed Gardens
Deuter Backpacks
Eagles Nest Outfitters, Inc.
Ed & Kathy Bergeron
First Light
Flatbread Company
Good to Go
Good Vibes Coffee
Grandy Oats
Hannaford Food & Drug
Home Depot
Hoo Rag
Hyperlite Mountain Gear
Janet Rain
Jerry's Furniture
J-Town Deli and Country Store
Julbo Inc.
Justin Morhauser
Lakes Region Coca Cola
Leave No Trace Center for Outdoor Ethics
Leavitt's Country Bakery
Leone, McDonnell & Roberts, P.A.
Lisa Baumgartner
Martini Northern
Mason & Mason Insurance
McKaella's Sweet Shop
McLane Middleton, Professional Association
Mountain Center Physical Therapy
Mountain Valley Mall Cinema
MountainSmith
Nalgene
NEMO Equipment
Nikwax USA
Nite Ize, Inc.
Northeast Elementary School
Oboz Footwear LLC
Peace of Mind Baking Co.
Penguin Gallery
Per Adamson
PETZL - Sky Ambitions, LLC
Princeton Tec
Private Label Select
Riverstones Bakery
Robert & Carol Anderson
Root Cellar Salon and Boutique
Ruth S. Innes
Ryan Knapp
Shannon Door Pub
Sugarmaker Bakery
Sunrise Shack
Tender Corporation
Terry Richards
The Glen House
The Local Grocer
The Metropolitan Coffee House
The Soaking Pot
Tuckerman Brewing Company
Underground Bakery & Cafe
UTILITY Made
Valley Originals
Vintage Baking Co.
Walter & Christen Tipert
White Mountain Cupcakery
White Mountain Oil & Propane
Wilderness Map Company
Zeb's General Store

...Thank you

25 Years

BY STEPHANIE TURNBULL FITZGERALD

This year, nearly 60 of you are celebrating 25 years as members of the Mount Washington Observatory! Within this group there are many names I recognize: Trustee Drew Landry, Life Trustee Ken Jones, Volunteers Bill Housum and the Bouffards. We have members from right here in the Mount Washington Valley and a few as far as Virginia, Alabama and Illinois. Some of you I have spoken to recently (Hi Edward! I told you your name would be in *Windswept*). Others, I encourage you to reach out at membership@mountwashington.org with your story, let us know your history with MWO.

What all our members have in common is that you have chosen to support our non-profit and we are so grateful for your help. Cheers to 25 years!

25 Years...

David Townley
Rob Burbank
Paul & Claire Bouffard
Richard J. Tucker
Sue Engle
John & Nancy Sherman
James & Donna-Belle Garvin
Karen Urbanik
Jim G. Gallant
John J. Ramaska
Eric P. Feldmann
Paul S. Bassett III
Jeff Thomas
Kenneth T. Mckenzie
Art Glaeser
Ms. Ann Kaiser
John W. Rice
Gisela & Paul Estes
Thomas Bindas
Andrew Verven
Walter Goettlich
William T. Housum Jr.
Bruce McLaughlin
Ann Marie Seaman
Jack & Deborah Heffernan
Catherine Paul
Preston & Brenda Conklin
Robert Marchese
Bill Woodason
Roy W. Ide
Craig Sutter
Robert Kravitz
Thomas Lewis
Edward Roundy
Arthur & Carol Viens
Chris Haviland
Kathleen Collins
Joseph DiClerico Jr.
Ira & Ann Seskin
Andrew L. Clark
Phil Clark
Lance O. Shaffer
James B. Ginty
Steven Yenco
Anthony J. & Carol Broccoli
Ken F. Trauger
Andrew Timbie
Kevin McEnaney
Kathleen Jones & Donald Perovich
Susan and Louis Kern
Roy A. Lundquist
Drew & Carol Landry
Frederick Wolf
David B. Stump
John P. Lamanna
Gerard L. Vachon
John & Patricia Hoffman
Mary H. Small
John McCullough

CORPORATE SUPPORT

EASTERN MOUNTAIN SPORTS®

EATON
Powering Business Worldwide

MT. WASHINGTON AUTO ROAD

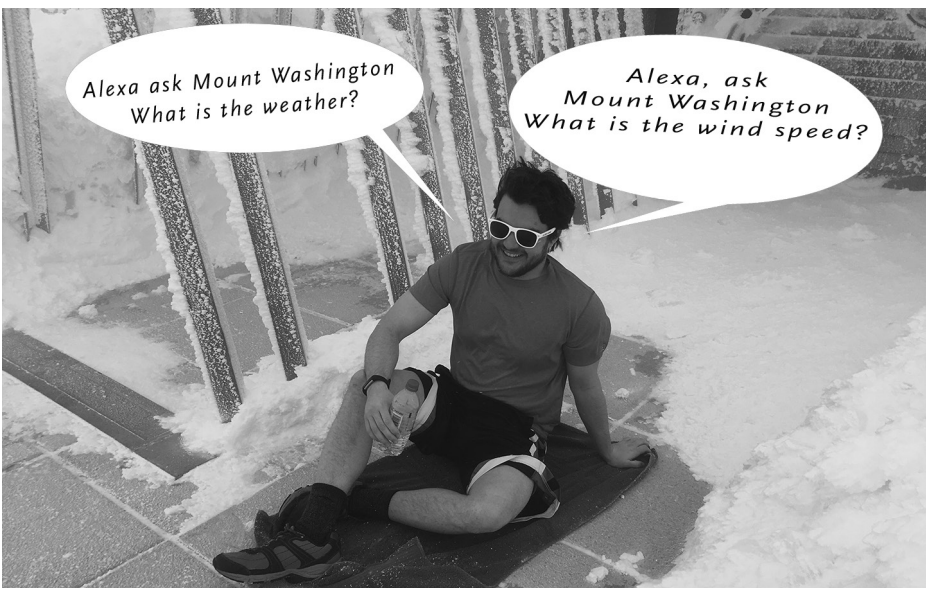
Obōz®
FOOTWEAR

Tribute & Memorial Gifts

Ron Pearce ..... In Memory of Claudio Ballester
Mary Ann Leekley ..... In Memory of William Bowden
Cynthia Boyle ..... In Memory of Douglas Boyle
Jonathan Sherwood ..... In Honor of Bob Brisebois
Norman H. Brooks ..... In Memory of Charles Brooks
William Cruse ..... In Memory of Doug Cooper
Nancy Eastham ..... In Memory of William Eastham
Denise Stinchfield ..... In Memory of Florence Garceau
Chris Gerath ..... In Memory of Robert Gerath
Ukranian Ladies of Saskatoon ..... In Memory of Betty Gosselin
Peter J. Crane ..... In Memory of Holly Huhn
Mr. Frederick J. Anderson ..... In Memory of Charles Kiel
Karl Wasner ..... In Honor of Jessica Levesque
Richard I. McCoid ..... In Honor of Edwin O'Malley
Mr. Josef A. Orosz, Jr. ..... In Memory of Josef Orosz, Sr.
Mr & Mrs. Eric Werme ..... In Memory of Marion Oser
Erica Broman ..... In Memory of William Putnam
Richard Ridolfi ..... In Memory of Leno Ridolfi
John Sappington ..... In Honor of Anne Sappington
Mary E. Sloat ..... In Memory of Bruce Sloat
Lawrence R. Hertz ..... In Honor of Henry Swenson
George Temple ..... In Memory of G. Ernest Temple
David Thayer ..... In Memory of Jill Thayer
Jerome Mello ..... In Honor of Richard Trask
Mr. William A. Twigg ..... In Memory of Robert Twigg
Michael Magent ..... In Memory of Robert Wassall
John Welsh ..... In Memory of Chris Welsh
Richard & Patricia Wexelblat ..... In Honor of Paul Wexelblat
Betsy Black & Cathy Menard ..... In Memory of Nancy H. Black

Lovely Lenticulars

Weather Observer Ian Bailey snapped this shot on Sept. 15, 2019 from the summit on a gusty day that saw winds generally blowing 50-70 mph with a maximum gust of 79 mph. The photo is a prime example of how lenticular clouds stack on each other as there are multiple air flow layers blasting up and over the summit causing the clouds to form past the peak. Not 10 seconds after Bailey took the photo, he got blasted by a gust, dropped his phone and shattered the screen. But he says it was worth it!



THE NON-PROFIT

MWOBS

MOUNT WASHINGTON OBSERVATORY

THE PREMIER INSTITUTION FOR MOUNTAIN WEATHER & CLIMATE EXPERTISE

PRODUCT TESTING & RESEARCH

A NATURAL LABORATORY

Each project has unique requirements that will incur varying costs as purpose, collaboration and expectations are identified.

~ CONTACT US TO LEARN MORE ~

- **Brian Fitzgerald** – Director of Science & Education
  bfitzgerald@mountwashington.org – 603-356-2137 x 225
- **Dr. Eric Kelsey** – Lead Research Scientist
  ekelsey@mountwashington.org – 603-356-2137 x 205
- **Keith Garrett** - Information Systems Administrator
  kgarrett@mountwashington.org 603-356-2137 x 230

WINDswept

PO Box 2310
North Conway, NH 03860
Phone: 603-356-2137
www.MountWashington.org