Fall/Winter 2020-21 Vol. 61 No. 3

WINDswept

The Bulletin of the Non-Profit Mount Washington Observatory

In a year when we've all felt like we're climbing the highest mountain, we hope you are "enduring this climb" in good health, in strong spirits and with sights on beautiful days ahead.

Mount Washington Observatory is no stranger to extremes but what has transpired in 2020 is certainly unprecedented. Thanks to you and others who care, our important work was possible this year.

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2020

Year End Appeal

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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.

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WINDswept

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Behind the Science

Windswept *Editor Marty Basch*

BY **MARTY BASCH,** EDITOR

The 20th annual Seek the Peak turned out to be a memorable one, but certainly not in the way anyone envisioned when planning for it started more than a year ago. But Observatory members, supporters, staff, trustees and more turned out in force for the virtual hike-a-thon that is so crucial to our operation.

Brand Manager Krissy Fraser reached out to volunteers, participants and others to create story flags to commemorate the event and also to hikers to seek their own peak, capture it in a photo and email it in. Scores of you rose to the occasions. Some of the vibrant, creative and simple story flags flew at the Weather Discovery Center in North Conway, a test drive of sorts, before they flew in an awe-inspiring sunrise event from the summit in late September. As for those photos, take a look inside these pages to see who you know. It could be you.

Also on the summit, we are proud to report the next-generation pitot static tube anemometer Pitot 20 has been put through a grueling battery of tests and is performing as well as expected. Summit Operations Manager Rebecca Scholand explains how the pitot came to be at the summit weather research station and describes some of the science behind it.

Being such a storied institution, there isn't a day that goes by without some sort of nod to our yesterdays. This winter marks the 150th anniversary of the Charles Hitchcock and Joshua Huntington expedition, the first winter scientific occupation of Mount Washington. Included in the group was photographer Amos Clough. A New Hampshire native, he was a pioneer in his field. Curator Peter Crane reviews a book telling of Clough's work on that expedition.

We often hear from members who find items that may be of interest to us. Trustee Jack Middleton came across Brad Washburn's acceptance speech when he received the Joe Dodge Award from the Appalachian Mountain Club in 1991. In that speech the explorer and photographer recalls climbing Mount Washington with Dodge, one of the Observatory's founding fathers. It's a good read.

Plus, there's some news in here about the summit's most famous occupant—Marty the cat. And no, we're not kitten around about it.

Constant Flux Is New Normal

Interim Executive Director Donna Dunn

BY **DONNA DUNN,**
INTERIM EXECUTIVE DIRECTOR

As you read this, the seasons are changing. The summit of Mount Washington has seen snow. The world in which we all live and work continues to evolve and adapt to new circumstances and new opportunities.

So does the Mount Washington Observatory. The challenges of the year presented opportunities for examination and introspection of our organization. This is work that every company and every nonprofit does from time to time. Sometimes circumstances cause us to look deeper and make more significant decisions. The Board of Trustees refined our Statement of Purpose to assure we are all focused on our reason for being:

"The Mount Washington Observatory exists to gather, disseminate and analyze daily weather data; to contribute to the critical, long-term weather and climate record essential to scientific understanding of weather and climate in a unique, extreme environment." (Adopted by the Mount Washington Observatory Board of Trustees June 2020.)

In addition, the Board of Trustees has reaffirmed the mission of the Observatory:

"Mount Washington Observatory is a private, nonprofit, member-supported institution with a mission to advance understanding of the natural systems that create earth's weather and climate. It serves this mission by maintaining a weather station on the summit of Mount Washington, performing weather and climate research, conducting innovative science education programs, and interpreting the heritage of the Mount Washington region."

The clarity of our focus on purpose and mission provides a foundation for today and for the future. We use these statements to evaluate our programs and activities, to look carefully at both what we do and how we do it. That examination pushes us to change what doesn't fit and to enhance those programs and activities that align with our purpose and mission.

The Mount Washington Observatory Board of Trustees takes this responsibility seriously. The result of this examination is a renewed focus on our origins in science and research.

To that end, the Board of Trustees has taken a bold step to assure our continued ability to stay true to our core. The main offices of the Observatory and our unique library of the Observatory and the Mount Washington region will be enhanced in our location in North Conway,

N.H. Sadly, we will close the Weather Discovery Center in North Conway. During the examination of our programs it became clear that the museum, while educational and interesting, isn't our strength. The museum closure allows us to refocus on science and research and develop creative educational programs to share that science with a broader audience.

In the time of a pandemic embracing our purpose and mission is critical. I've heard people say they want to get back to normal. Others say they want to find the new normal. I believe that our current state of flux is our new normal. That static and comfortable is not and will not be possible for organizations like the Mount Washington Observatory, as exemplified by the Board of Trustee's actions. Constant adaptation and evolution will be the hallmark of the days and years to come.

This renewed focus on science and research is exciting. You will read in other parts of *Windswept* about new research and new product testing, all part of our science work. We now have fewer and more focused educational programs using new delivery methods, targeting new audiences.

New challenges and new opportunities. Stepping up to use these opportunities to get better, be creative and focus on our purpose and mission. That's the way to survive and thrive in our new normal of constant flux.

Virtual Hike-a-thon Makes For A Memorable 20th Seek the Peak

Story flags fly from the Weather Discovery Center.

The non-profit Mount Washington Observatory celebrated its 20th anniversary Seek the Peak hike-a-thon in July with over 300 hikers participating virtually around the country raising nearly $110,000 in pledges. The events' proceeds benefit the Observatory's summit operations continuing its 87-plus year data set used in forecasting, education and science.

Participants were encouraged to hike from anywhere between July 1-20 and to share their hikes on the Seek the Peak Facebook group page to continue to inspire the Seek the Peak community and to ultimately be included in a video bringing together the STP participants in a virtual format. Additionally, participants were asked to send along a story flag reflecting their hike of choice and years of participation to be included in a collection of flags from participants spanning the 20-year event.

Hikers took the challenge to heart, trekking up peaks beyond Mount Washington. Some chose different massive mountains in the Presidential Range while others stuck closer to home in town forests, woodlands, and state parks. Long time participants the Nowicki family went up and down hills in their neighborhood to equal the elevation of the Ammonoosuc Trail. To keep their STP experience authentic, they had candy and gifts sent from North Conway's iconic shops Zeb's and The Penguin to share after their outing. Robin Hirsch who has been involved with Seek the Peak since the beginning opted to finish her Sleeping Giant Mountain (Conn.) Master certificate, totaling 50 miles of trail over several months, to round out

Top: Summit Operations Manager Rebecca Scholand, Director of Development Stephanie Fitzgerald, Brand Manager, Krissy Fraser and Interim Executive Director Donna Dunn take part in the Facebook Live stream. Right: Backpacker Get Out More Tour members Steve and Jordan address participants.

her virtual STP event.

"It was truly amazing to see the Seek the Peak community come together virtually through the Facebook Group and with emails to share their hikes and experiences and to inspire each other," said Brand Manager Krissy Fraser. "We are so thankful for our participants and sponsors for continuing to make this event incredibly special and a successful critical fundraising event in support of the Observatory."

Participants who reached a $200 fundraising goal were rewarded with an exclusive Cotopaxi backpack provided by presenting sponsor Eastern Mountain Sports. Leading fundraisers were awarded special prizes. Chris Nichols was the top fundraiser raising over $8,000 with 20-year participant Lee Eckhardt close behind raising a clever $6,288—that's the elevation of Mount Washington. Other 20-year Seek the Peak hikers Brad Griswold, and Pat and Brenda Daly were recognized for their dedication. A special Brad Bradstreet Award recognizing a love and enthusiasm for STP and the Observatory was awarded to longtime volunteer coordinators of the event and 2020 participants Hank and Linda Dresch. The Observatory went to Facebook Live to announce the awards and prizes.

You can view both the 20-year celebration video and the STP 2020 virtual hike videos on YouTube.

Seek the Peak is made possible with support from presenting sponsors Oboz Footwear and Eastern Mountain Sports with additional support from the Mt. Washington Auto Road, Martini Northern, First Light, White Mountain Oil, Mason & Mason Insurance, Delta Dental and WMWV 93.5.

Seek the Peak Story Flags Fly From Summit

Staff ascended to the summit during the early morning hours to fly the flags.

The Mount Washington Observatory celebrated its amazing Seek the Peak participants and the 20th anniversary of the event that went virtual in 2020 by raising nearly 300 story flags from the summit tower as the sun rose on a chilly September morning.

Because of the COVID-19 pandemic, the Observatory's longstanding hike-a-thon was turned into a virtual event with dedicated participants encouraged to create a STP story flag to fly from the summit in a vibrant and inspiring commemorative display. Hikers rose to the challenge as did the nimble fingers of volunteers Jan Basch and Karen Franke who stitched together several strands of flags that turned into an epic kaleidoscope of color and memories.

Due to restrictions, the event to reveal the flags was kept to a small group of MWO staff. They traveled to the summit by van in the early morning hours on Monday, Sept 21 arriving just before sunrise on a perfectly beautiful morning with light winds averaging 12 mph and temperatures just above freezing. As the sun rose the staff hoisted the flags with thousands of Seek the Peak participants on their minds from the 20 years of the event. A pulley system was used to raise the lines of flags from the observation deck to the top of the summit tower giving the impression the human anchors were flying strings of kites at 6,288 feet.

"It was truly an amazing morning and so special to finally hoist the flags that so

Top: The flags fluttered in the light wind. Left: Flags came from a variety of STP participants.

many sent in with so much sentiment," said Brand Manager Krissy Fraser. "We can't thank our Seek the Peak and MWO friends enough who shared their stories with us. It was an honor to raise the flags contributed by our STP family on the summit."

The hoisting of the flags came in the waning hours of the summer season and happened to coincide with World Peace Day.

The Seek the Peak hike-a-thon raises a significant portion of MWO's annual budget to support its work in weather observation, education and research atop Mount Washington. The event brings hundreds of participants to the White Mountains annually. Not only are participants encouraged to climb Mount Washington, they are also motivated to seek their own peak which many did. Seek the Peak 2021 dates will be announced soon at mountwashington.org.

Seek the Peak was made possible with support from Oboz Footwear, Eastern Mountain Sports, The Mt. Washington Auto Road with additional sponsors including Martini Northern, First Light, White Mountain Oil, Mason & Mason Insurance, Delta Dental and WMWV 93.5.

Science in the Mountains Lecture Series Now Runs All Year

The Mount Washington Observatory in July announced Science in the Mountains (SITM) is now a year-round virtual lecture series. The series features weather focused presentations from Observatory staff and other field experts.

Science in the Mountains presenters deliver high-quality, educational topics for a general weather-loving audience by providing engaging lectures about scientific research, stories and issues happening in the White Mountain Region and in the broader meteorological and climatological community.

"We are excited to move SITM to a virtual space because it really extends the reach for weather fans and MWO followers," said Director of Science and Education, Brian Fitzgerald. "Each lecture will take a deep dive into the many fascinating aspects of weather in its behavior from extreme weather and its cause to the history of many extreme weather events that have impacted our region."

The program is free and is hosted on Zoom and streamed via Facebook Live on select Tuesday evenings at 7 p.m. The format includes a 45-minute presentation followed by a Q&A session to inspire discussion. Viewers are encouraged to register for the individual lectures that can be found on mountwashington.org. The programs will also be recorded and posted to mountwashington.org/SITM and available on YouTube.

For more information about this program visit mountwashington.org or follow us on social media at Facebook/MWObs to be kept up-to-date on the latest program topics. For further information on other educational offerings with Mount Washington Observatory including distance learning and professional development opportunities visit mountwashington.org or call (603) 356-2137 x225.

Weather Observer Nate Iannuccillo is streamed live during a Science in the Mountains program.

Hiker Injured During July Snow Arch Collapse

"A basketball court size amount of snow" collapsed on top of a hiker in Tuckerman Ravine this past summer. Photo by New Hampshire Fish and Game.

New Hampshire Fish and Game officials say a hiker was lucky to be alive after a snow arch collapsed on him while in Tuckerman Ravine in July.

The man received serious but non-life threatening injuries.

On July 18, 2020, a 911 call was received for a hiker who was caught in an avalanche in Tuckerman's Ravine Trail. The call was transferred to a conservation officer. When the CO spoke to the caller, it was relayed that he watched one person get caught in an avalanche. While obtaining more information, the caller stated that other hikers, near him, were saying that there was potentially two people caught.

When the situation was described further, it was understood that there was not an avalanche but an actual collapse of a snow formation known as "The Tuckerman Snow Arch."

Calls were made to Appalachian Mountain Club, Androscoggin Valley Search and Rescue Team, and other conservation officers in order to respond to the area. While responding, further information was received that there was only one person under the snow.

A coordinated response was organized and hikers were relayed up the Sherburne Ski Trail to Hermit Lake Shelter where they hiked up to the victim's location. Due to the rescue being on the White Mountain National Forest, U.S. Forest Service contributed resources including ATVs and hikers in order to assist with the rescue.

The victim was identified as 28-year-old Alphonse Riang of Quincy, Massachusetts. It was stated that Riang went off the trail and under the snow arch to take a video of the area. The snow arch collapsed while Riang was underneath it, crushing him with what was described as, "a basketball court size amount of snow."

It is unknown how long Riang was under the snow and ice, however passing hikers who saw and heard the event, helped pick up and move the large ice/snow blocks that fell on him and moved him to safety.

AMC personnel from Hermit Lake were the first to arrive at Riang, after he was moved from the snow collapse. As more rescue personnel arrived it was determined that Riang had received serious but non-life-threatening injuries. Riang was assisted down to Hermit Lake shelter where he was then loaded onto an ATV.

Riang was brought down the Sherburne Ski Trail and transported to Androscoggin Valley Hospital for treatments of his injuries.

Authorities said that Riang is very lucky to be alive and this incident should act as a reminder to stay on the trail and not go on or under any suspended snow bridges or arches of any kind, especially in the summer months when all snowpack is losing its structural integrity due to the sun and temperature.

This Is My Last Winter and I'm Not Kitten Around

TRANSLATED BY
SAM ROBINSON

Hello from the summit of Meow-nt Washington!

The days are starting to get shorter and the air is starting to feel a little cat-nippy. I find myself wanting to doze off more than usual, even though I should purr-obably be cat-ching mice. I am not sure if it is be-claws of the seasons changing, or the purr-fect cardboard box filled with cozy sweatshirts that I have taken over as meow-n. The other day I heard we had our first icing event of the season, although I missed out on it because I was napping, of course. This year has been quite different than usual with the current circumstances around the world, and I really miss all of the visitors and volunteers who would purr-vide me with neck rubs, treats, and paw-some toys. There has also been the addition of four new humans who I have gotten to know pretty well. One of my new furr-vorite cat-tivities is to lay in the nook of the storage cabinet in the bathroom, and pounce out and surprise the unexpecting newbies. You should see the look on their faces, their whiskers practically stand straight up!

Speaking of new faces, I think it is time I announce that I will be retiring from the summit this winter. After many years on the summit it is time for me to seek some lower elevation. I am 15 after all and this meow-tain is pretty extreme. While we are starting to look for my replacement I am confident the new summit feline will be able to fill my paws. It will be sad to go, but I am looking forward to seeing some trees and greenery. Thank you to all my furr-tastic friends and supporters. It has been a purr-fect time on the summit.

Observatory Unveils Next-Generation Pitot Static Tube Anemometer

BY **REBECCA SCHOLAND**

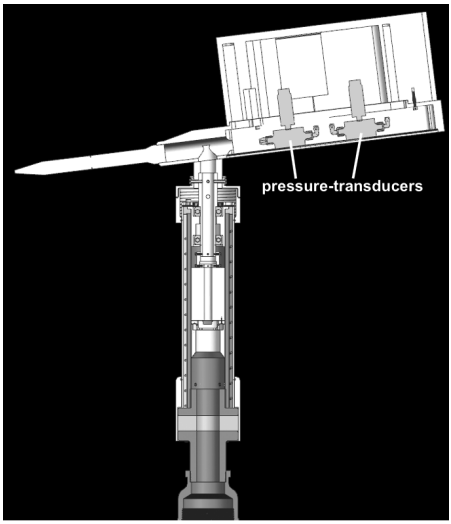
The Mount Washington Observatory is known as "Home of the World's Worst Weather" and for good reason. The most notable factor contributing to this moniker is our winds. Throughout our history the Mount Washington Observatory has deployed and utilized several styles and types of anemometry on the summit to capture our wind data. Although the speed and intensity of winds provide a significant design challenge, persistent and severe rime ice accumulation presents perhaps the greatest impediment through the majority of the year.

The pitot tube on the summit.

It is for this reason and the lack of off-the-shelf solutions that the Mount Washington Observatory has had to design and build our own anemometers. Over the years the most notable in-house designed anemometer was the pitot static tube anemometer that we currently use. If you have followed us over the years you are most likely familiar with its appearance.

Utilizing aircraft technology, a pitot static tube is fitted onto a tail allowing it to vane into the wind on top of our observation tower. Our system reverses the initial concept of a pitot tube that would normally provide an aircraft with its airspeed.

When used for the purposes of determining airspeed of an aircraft, it is assumed that the atmosphere is stationary and the craft moves through it. This movement through the atmosphere exerts a pressure (total pressure) on the tip of the tube and small ports perpendicular to the airflow provide static pressure. The difference between these two pressures can be used to calculate the airspeed of the aircraft. In our application the pitot tube is stationary while the atmosphere moves past exerting a total pressure on the tip

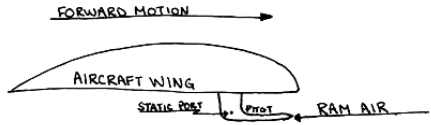


Model drawing of Pitot 20.

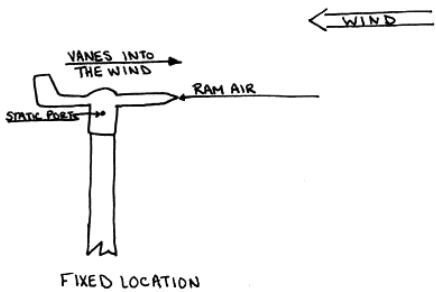
and the small ports reporting the static pressure. We are then able to calculate the winds speed. Additionally our system uses pressure transducers to digitally output this data. Our current pitot static tube anemometer system has worked very well for us over the years, but innovation is the name of the game as technology has improved over the years.

The next-generation pitot static tube anemometer Pitot 20, named because it first became an operational instrument in 2020, resulted from a multi-year collaboration between the Observatory, General Electric, and the University of Massachusetts-Lowell Engineering program. The goal of the project was to develop a new operational anemometer for the summit that improved upon the current Pitot 19 model and also addressed a few other needs and wants. The first of these was a more simplified design that would allow for easier removal and installation for maintenance and calibration. The second was to explore the possibility of shortening the length of tubes needed to run from the pitot tube itself to the pressure transducers located in the weather room. Lastly was to explore an upgraded heating system to reduce the accretion of ice during the worst of conditions on the summit.

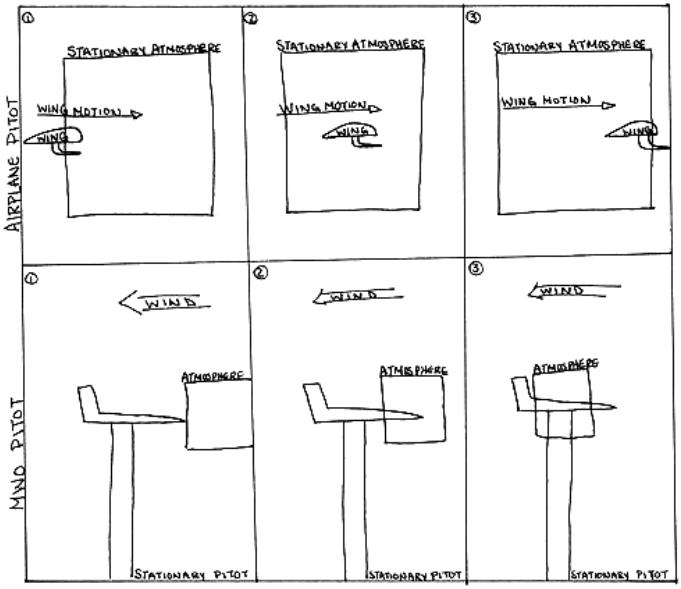
The new Pitot 20 system was able to achieve all three of the desired goals.



Above: The pitot tube attached to an airfoil. Below: The pitot tube attached to a vane representing our pitot static anemometer. Note: Static port is not drawn in actual location.



The new design was not only more robust, but in achieving the second goal, the significant length of tubing that would otherwise be required to be fed down the tower (such as in the Pitot 19 system) was removed, thus drastically improving the installation process. This means that the length of tubes needed to run from the total and static pressure ports to the pressure transducer are approximately six inches in length vs. the current tube length for Pitot 19 of approximately 70 feet. By reducing the tube length we effectively decreased the internal volume of our



The pitot tube attached to an airfoil vs. pitot tube attached to a vane measuring airspeed and wind respectively.

system producing a system that is more sensitive to smaller and more rapid wind variations. The new design also allowed us to install a more powerful and effective heating system to help keep Pitot 20 de-iced in heavier icing conditions.

The next-generation pitot static tube anemometer project began in October of 2015 and testing of the system began on the summit in August of 2018. During this testing period Pitot 20 was run side by side with the previous Pitot 11 and existing twin Pitot 19 to work on bugs in the system and make small adjustments to the mechanical components. As of September 2020 Pitot 20 is preparing to undergo final testing and calibration for official deployment as a primary instrument on the summit of Mount Washington.

The process of designing and building our next-generation pitot static tube anemometer is a testament to the continued progress the Observatory makes in improving the methods used to collect data. By using new technology we are able to reinvent systems that work in our unique environment while maintaining our legacy of recording the weather on Mount Washington. A very large thank you to all that have worked on this project with the most notable being Dr. Eric Kelsey (Plymouth State Research Professor), Keith Garrett (MWO Information Systems Administrator), Pete Gagne (MWO Hardware Systems Specialist), Edward Walton (GE Mechanical Engineer), Michael Gagnon (GE Mechanical Engineer), Matthew Thomas (GE Mechanical Engineer), and Joe Chaves (GE Electrical Engineer, retired 2019).

Summit Operations Manager Rebecca Scholand also played a role in the project.

Virtual Hikers Rule 20th Seek the Peak

BY **KRISSY FRASER**

Frankly, when we made the decision to hold the 20th Annual Seek the Peak virtually in July during the COVID-19 pandemic we didn't know what to expect. We were trekking on new ground. We were nervous but what kept us going was you and all the other Observatory supporters. We knew if we held it, you would come—even virtually—to at least seek your own peak.

You did.

Some of you scaled Mount Washington.

Angie Dell' Erba did a Presidential Traverse, a strenuous 20-mile trek over the Presidential Range.

Some of you hit your local parks. Some of you hiked other bucket-list type of peaks in New England.

No matter where you hiked, you stepped up to support the Observatory and for that we thank you. We encouraged you to post your photos on our Facebook page or e-mail them in to us. You did. We're sharing a handful of the many photos of you, the reason Seek the Peak has been an Observatory staple for 20 years!

Right: Bethany Ericsson masked up in style during her STP hike. Below: Top fundraiser Christopher Nichols of The Nichols Clan team (top team fundraisers) rambled up to Lonesome Lake with its stellar views.

Thilda Medina and family rock the STP event t-shirts at the Mount Washington summit.

The Nowickis trekked up trails near their hometown to equal the vertical on the Ammonoosuc Ravine Trail up Mount Washington.

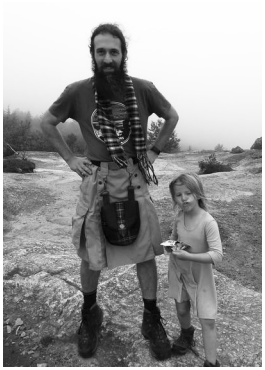
Courtney Evans hiked Maine's tallest peak, Mount Katahdin, the northern terminus of the Appalachian Trail.

Alison Dunn hiked to the Blue Hill Observatory.

The family that hikes the Nancy Pond Trail together—the Koskis—support the Observatory together.

Donna Gamache and crew know it's just not a hike until you load up on the PB&Js.

Jeanne-Marie Maher and Michael Pahl of The Seekers team made the trek up Mount Stanton.

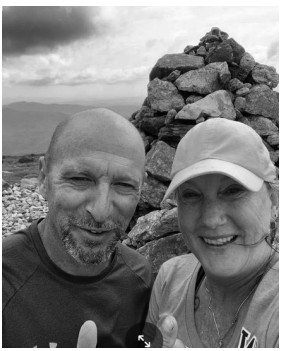


Kilted Hiker Jason Dubrow and daughter Callisto stand tall on the trail.

Outfitted in tried and true STP schwag, Lee Eckhardt is all smiles on his way to the Mount Washington summit. Eckhardt has participated in every STP and was this year's second top fundraiser.

Matt Thompson thanked a donor during his ramble.

Richard Veneziano gives the thumbs up at 6,288 feet.



Linda Roza climbed three peaks—Mounts Eisenhower, Pierce and Hale.

Richella Simard and her four-legged companion take a break during their STP outing.

With smiles like that Nora and Roanne Robbins created their own sunshine on Mount Moriah.

Amy Gustavson proudly displays the prayer flag she made for STP.

Washburn Recalled His First Mount Washington Ascent in 1991 Speech

BY **JACK MIDDLETON**

Brad Washburn

Brad Washburn was one of the most illustrious Trustees of the Mount Washington Observatory. He was the founder of Boston's Museum of Science and a famous cartographer, explorer, photographer and mountaineer. Washburn died on January 10, 2007 at the age of 96.

On September 27, 1991 he received the Joe Dodge Award from the Appalachian Mountain Club. In his acceptance speech, he regaled the audience about his first ascent of Mount Washington in the company of one of the founders of The Observatory, Joe Dodge:

"One of my happiest memories of Joe was an incident which took place right here at the end of 1926. My father, my mother, my brother, Sherry, and I, with several friends, spent the week after Christmas at the Glen House—then run, as never before or since, by Fred and Addie Pike, with whom we lived in unbelievable and total comfort—a veritable blood-bath of the most wonderful, cholesterolic food imaginable!—for

four dollars and fifty cents a day; everything included—box lunches and the works!

As New Year's Day neared, my family returned to Boston and I stayed on for a couple of days. That was the first year that Pinkham was open in the winter. All the Christmas hikers had left—and, as yet, of course, there wasn't any skiing at all. Even though I was only sixteen, Joe had asked me to spend New Year's with him . . . a tremendous thrill!

Joe Dodge

The main road from Gorham to Jackson was smooth snow a foot deep. The week before, we'd got to the Glen in a huge sleigh, pulled by two enormous steaming horses. No plows yet. I snowshoed over to Pinkham from the Glen on a cold, beautiful afternoon, December 31, 1926. Joe and I were joined at twilight by a lone fellow who was skiing from Gorham to Jackson right down the road. He'd got a late start and wanted to spend the night here. Just three lone fellows for the first New Year's Eve celebration ever staged at Pinkham Notch!

We had a sumptuous meal together in the old lodge. Remember, Tine didn't appear on the scene till the following fall.

The next day was cloudless, cold and dead calm. You could walk out the front door, turn around and almost touch the summit. After breakfast, our new friend skied off down the road to Jackson, and Joe, after a couple of moments of serious deliberation outside, exclaimed in his own inimitable way, 'Jesus Christ, let's get the hell out of here and go up the mountain!'

In no time we were on our way—on snowshoes, along an already well-packed trail. Not the Fire Trail or the Sherburne—these boulevards were yet to be cut out. The old Tuckerman trail, without a single zig-zag, went straight to Hermit Lake over rocks and roots and uncut windfalls, as if it had been laid out with a plumb line!

The snow in the Ravine was very deep and loose, so we decided not to go up

the Headwall. Instead, we climbed to the crest of the Ravine by the dramatic but safe Boott Spur Gully—the one to the left of the icicles. Then we swung left along the ridge and out to Boott Spur itself—not a breath of wind—not a cloud anywhere—crisp frost-feathers underfoot.

I'll never forget the beauty of the summit that afternoon across Tuckerman, flanked by the crags of Lion Head and towering far above tiny, frozen Hermit Lake. After a few priceless moments of exultation, we headed down the ridge and wallowed our way back to Pinkham, arriving just at darkness.

We'd left the door unlocked, of course, and a pad and pencil on the table with a note: 'Make yourself comfortable and have a cup of coffee. We'll be back, late p.m. Please sign your name before you leave. Joe Dodge and Brad Washburn.'

Not a single name was on that sheet of paper. Not a single soul had stopped at Pinkham, at any time, all day long on New Year's Day 1927!

Every detail of that wonderful climb is etched vividly in my memory for life—the only day I ever spent on Mount Washington alone with Joe Dodge. At that time he was our hero, my hero, and spending a day alone with your hero, then or today, whether you're young or old, wherever you are, is a thrilling and never-to-be forgotten experience."

Trustee Jack Middleton worked at the Observatory in the early 1950s.

Virtual Learning Thrives on Mount Washington

BY **BRIAN FITZGERALD**

Despite a dearth of opportunities to provide in-person programming this past summer, virtual programs at MWO have kept students of all ages connected to the work of our talented staff. The transition of Science in the Mountains from an in-person summer lecture series to a virtual, year-round space has been an incredibly positive way to reach a larger audience who might otherwise not have access to this free learning opportunity (more about the Science in the Mountains series on page 11). Throughout the summer, Weather Observer/Education Specialists Nicole Tallman and Nate Iannuccillo connected with universities students, technology companies, Rotary Clubs, retirement communities and a host of other learners.

In response to the unprecedented need for virtual learning this past spring, MWO launched the free "Home of the World's Worst Weather Live" program that brought live and recorded programming directly from the summit of Mount Washington into home classrooms across the region and country.

With the continued need for high-quality, adaptable resources, MWO is proud to be able to offer a free virtual classroom program once again that will be featured live once a week on Mondays. The target audience for this program are middle-schoolers that are studying weather and climate in the classroom. For more information on this program, check out mountwashington.org/classroom.

Finally, the WeatherX Curriculum Development Project continues in earnest—now in the middle of MWO's three-year award from the National Science Foundation. Like many projects, the WeatherX curriculum that was slated for its first round of instruction and testing in classrooms throughout Northern New Hampshire and Western Maine had to wait until this fall. Significant work was undertaken by the project team to adapt materials made for in-person classroom teaching to work for completely virtual or hybrid learning styles.

There's tremendous excitement to get students involved in the first unit lessons that feature Mount Washington Observatory weather data as a means for teaching concepts in data analysis and computational thinking. Additionally, one of the aims of the project is to inspire middle school students to STEM careers, a great way to connect students with our Weather Observers who use their own education in the sciences to perform a fascinating job on the Northeast's highest peak. In tandem with this initial round of classroom testing, work on developing and finalizing a second unit, slated to be tested this spring, will focus students on what data can tell students about extreme weather events in their local communities, and in understanding the threats from these events, we might build more resilient places to live.

Spring/Summer 2020 Weather Data

	APRIL	MAY	JUNE	JULY
Temperature (°F)				
Average	19.5	34.6	46.5	53.6
Departure	-4.4	-0.9	+1.5	+4.5
Maximum	41	66**	68	68
Date(s)	13th	27th	18th	9th
Minimum	-2	7	18	44
Date(s)	22nd, 23rd	9th	1st	14th, 15th
Precipitation (inches)				
Monthly	8.79	6.38	8.12	10.86
Departure	+1.35	-1.80	-0.28	+2.09
24-hour Maximum	1.91	1.16	3.49	2.54
Date(s)	9th/10th	11th/12th	28th/29th	10th/11th
Snowfall (inches)				
Monthly	48.6*	28.9	1.1*	0.2*
Departure	+13.0	+16.7	+0.1	+0.2
24-hour Maximum	13.6	11.9	0.8	0.2*
Date(s)	9th/10th	8th/9th	1st	14th
Season Total	282.6	311.5	312.6	0.2
Departure	+14.6	+31.3	+31.4	+0.2
Wind (mph)				
Average	40.6	34.0	23.2	26.3
Departure	+5.9	+4.9	-4.4	+0.6
Peak Gust/Direction	125 NW	123 W	86 W	84 W
Date(s)	10th	9th	4th	26th
Days 73+	18	16	5	4
Days 100+	8	6	0	0
Other				
% Sunshine	32	46	41	32
Clear Days	1	1	3	0
Partly Cloudy Days	5	9	5	6
Cloudy Days	24	21	22	25
Days with Fog	27	22	27	29
Days with Rain	5	8	21	22
Days with Snow	26*	13	4*	1*

**Some or all fell as hail/small hail*
***May maximum temperature—monthly record high of 66°F equaled; record originally set on May 22, 1977.*

Transition Between Seasons Is Always Interesting

BY **RYAN KNAPP**

This period is all about the transition from spring to summer where cold gives way to heat, snow gives way to rain, and thunderstorms start bubbling up over the region once again.

April 2020

A strong low moved up the coast the first providing light snow that transitioned to freezing rain on the second/third with glaze ice accumulating at rates of 8 inches/hour at times. Precipitation tapered by the fourth but fog lingered. A cold front on the fifth provided a wintry mix prior to tapering on the sixth. The seventh saw intermittent fog as a weak cold front passed. A weak low on the eighth provided snow but it would be a pair of stronger lows on the ninth/tenth that brought over a foot of snowfall and triple digits gusts that peaked at 125 mph on the tenth. Additional snow and triple digit gusts lasted into the eleventh with whiteout conditions occasionally. A weak ridge provided a break on the twelfth but a warm front approached late in the day providing light snowfall. Ahead of the front on the thirteenth, temperatures rose to 41°F and moderate rain along with warm fog melted the snowpack from 21 inches at daybreak to 6 inches by day's end. Temperatures plunged to the teens on the fourteenth and light snowfall fell as a cold front passed. Another cold front on the fifteenth plunged temperatures into the single digits and provided light snow that lingered into the sixteenth.

The seventeenth saw fair skies initially but fog and snow returned overnight and through the nineteenth as low pressure passed over southern New England and then up the coast. The twentieth saw fair skies ahead of a pair of cold fronts on the twenty-first/twenty-second. The fronts provided fog, snow, high winds and cold temperatures the twenty-second/twenty-third. Fog broke on the twenty-third. The twenty-fourth/twenty-fifth saw fair and seasonal weather apart from a few flurries that brushed by from a low passing to the south. The low shifted northward on the twenty-sixth with snow. Winds and newly fallen snow resulted in whiteout conditions on the twenty-sixth/twenty-seventh. Snow tapered and wind diminished on the twenty-eighth as the low exited and high pressure built in for the twenty-ninth/thirtieth. A low from the Ohio River Valley resulted in rising temperatures with freezing rain and rain as a warm front moved through overnight.

May 2020

As low pressure tracked northeast, rain continued and winds peaked at 111 mph

on the first. Freezing rain returned overnight then tapered as the low exited and high pressure returned for the second. A weak warm front on the third brought light snow prior to temperatures rising to 42°F later in the day. A cold front brought colder temperatures and light snow the fourth/fifth. High pressure provided fair weather conditions for the fifth and most of the sixth. A cold front the sixth/seventh provided light snow. Summits cleared early the seventh but fog and snow returned overnight as a coastal low passed. The low dumped an additional 14+ inches of snow on the eight/ninth. As the low departed, temperatures plunged tying a daily record low on the ninth. Light snow and cold temperatures lingered as the low exited on the tenth and a tight pressure gradient on its backside resulted in gusts as high as 107 mph. Brief clearing on the eleventh was quickly ended by another low and associated cold front from the west that provided 8+ inches of snow by the time things wound down on the twelfth. Cold air behind the front plunged lows to 9°F on the thirteenth tying that dates daily record low. High pressure then built which improved temperatures and fair weather conditions through most of the fourteenth. A warm front swung in for the fifteenth providing snow transitioning to rain as temperatures rose.

A cold front on the sixteenth resulted in rain transitioning to freezing rain. High pressure built over the east coast providing a blocking pattern that resulted in mostly clear skies, mild temperatures, and relatively low winds through the twenty-fourth. A weak disturbance the twenty-fifth/twenty-sixth resulted in fog/clouds and scattered showers. A southerly flow boosted temperatures on the twenty-sixth and into the twenty-seventh peaking at 66°F which tied the monthly record high. Diurnally driven thunderstorms formed in the vicinity of the summit on the twenty-seventh resulting in flooding in Pinkham Notch. Thunderstorms passed overhead on the twenty-eighth and a cold front on the twenty-ninth provided additional thunderstorm activity. Light rain and cooler conditions trailed the front on the thirtieth. An upper level trough and a cold front the thirty-first dropped temperatures into the teens and resulted in rain transitioning to snow.

June 2020

A weak shortwave on the first provided nearly an inch of light snowfall. A warm front the second provided rain showers and rising temperatures. Low pressure passed on the third and provided light rain that melted what remained of the June snowfall. Rain lingered early on the fourth but tapered as a clearing pattern briefly set up. Diurnally driven thunderstorms popped up and passed on the fifth. A cold front on the sixth returned fog and provided light rain through the day which lingered into the seventh as an upper level trough passed. High pressure provided fair weather on the eighth. A warm front on the ninth provided ice pellets followed by light rain prior to tapering. High pressure passed early on the tenth with low pressure from the west swinging a warm front and associated light rain late in the day. A cold front on the eleventh provided light rain with dry air

trailing it providing clearing late. Fog returned on the twelfth as a cold front passed and an upper level trough on the thirteenth provided continued fog. As the trough moved through, light ice pellets and rain showers fell on the fourteenth.

High pressure provided low winds, fair skies, and warm temperatures the fifteenth to eighteenth. A cut-off low from the south moved north on the nineteenth/twentieth providing scattered rain showers and thunderstorms. A trough set up on the twenty-first/twenty-second, which resulted in stronger thunderstorms, moderate to heavy rain, and hail. A long-wave trough lingered the twenty-third to twenty-seventh providing daily convective activity, mainly during the afternoon and early evening hours. While most of the thunderstorm activity formed in the leeward sides of the White Mountains, a few minor rain showers passed over the summit itself. A zonal flow over this period kept temperatures above normal with humid conditions. The twenty-eighth saw a brief break during the morning, but a warm front from a low to the southwest resulted in thunderstorms and rain for the afternoon and overnight. The low stalled and a stationary front set up overhead for the twenty-ninth/thirtieth resulting in 4.84" of rain and drizzle for the end of the month.

July 2020

An upper level trough and the stalled low to the SW dumped another 1.52" of rain on the first. High pressure early on the second gave way to a cold front with some brief drizzle overnight. A weak low to the south on the third provided drizzle early followed by clearing later and into the fourth as high pressure built. A trough returned fog and light rain on the fifth. A zonal flow allowed for clearing and fair weather for the sixth/seventh. Diurnal instability on the eighth provided thunderstorms and rain/drizzle. The remnants of Tropical Storm Fay affected the summit the tenth/eleventh with thunderstorms and moderate to heavy rain. A cold front trailed Fay as it exited and delivered over an inch more of rain on the twelfth. An upper level trough the thirteenth/fourteenth provided thunderstorms, hail, and rain. A ridge provided clearing for the fifteenth.

A moist flow from the south on the sixteenth returned fog and drizzle and a warm front on the seventeenth provided rain and thick fog. High pressure provided intermittent clearing the eighteenth/nineteenth. A cold front overnight and into the twentieth returned fog and light rain. Another cold front the twentieth/twenty-first provided additional light rain/drizzle. A low from the west on the the twenty-second provided light/moderate rain and a cold front trailing the low on the twenty-third provided some additional rainfall. High pressure provided fair weather for the twenty-fourth/twenty-sixth. A backdoor cold front returned fog and rain for the twenty-seventh with a secondary cold front from the west passing on the twenty-eighth. An upper level trough approached on the twenty-ninth and passed on the thirtieth providing thunderstorms and over an inch of rain. Clearing from a building ridge ended the month.

12:34 PM Mon. April 13

Early April. Astronomical and meteorological spring. In the valleys below, birds are fluttering in the trees, crickets are chirping in the woods, and new life is beginning to emerge from the ground. However, as Weather Observers and those familiar with Mount Washington know, winter still has the summit firmly in its frozen grip. Observers on the summit battled one of the most intense icing events of the current winter season on April 3, resulting in some stunning photos and helping to illustrate why the Observatory needs to be manned throughout the year to maintain its operations.

This particular event actually began on April 2, with light snow beginning just after midnight. Snow lasted throughout the entire day, with rime ice also coating everything on the summit. However, once again around midnight, things were about to change. As the wind direction started to shift slightly to the east, warmer temperatures aloft allowed the snow to switch to a messy mix of freezing rain and ice pellets (sleet). Instead of the light, feathery, and relatively-easy-to-remove rime ice formations, these types of precipitation form hard glaze ice. Glaze is one of the least-enjoyed weather phenomena among Observers. Not only does it make it treacherous to navigate outside, but it can be very difficult to adequately remove from our instrumentation.

During normal winter conditions, we typically go to the top of the tower to de-ice our instrumentation once per hour, usually right before taking an observation. On this day, the glazing was so severe we were going outside every 15-30 minutes to smash thick layers of ice off the wind vane and anemometers. At one point, it was estimated that around 8 inches of ice was accumulating per hour!

These extreme conditions were due to a combination of constant freezing rain and sleet, high winds, and moisture-laden air from the east that resulted in dense, wet fog. Some of the pieces of ice had grown to over 2 feet in length, forcing the Observers to be exceptionally careful and mindful of their positioning while removing the ice in strong winds.

—AJ Grimes, Weather Observer

8:11 AM Thurs. May 28

My road with the Mount Washington Observatory has come to an end. But what a journey it has been! Over the past 7 years I have had the privilege to work with amazing, passionate people dedicated to the mission of the Observatory. I've witnessed some of the most extreme weather conditions on the surface of the Earth and had incredible experiences that will last a lifetime. I've contributed to building nearly a

century's worth of weather and climate data and done my part to carry on the legacy that started with 4 intrepid individuals in 1932.

I want to sincerely thank the staff at the Observatory for all they have done for me over the years. I started as an intern here nearly a decade ago in May 2011 for my summer internship and fell in love with the mountain and working as a Weather Observer. After finishing up my degree in meteorology I was lucky enough to return to the mountain in 2013 and begin working first as the Staff Meteorologist and Night Observer for 3 years before switching to being the Education Specialist and eventually Shift Leader. Through this time I've met hundreds, if not thousands of people who realize how special of a place this is and are willing to help support our nonprofit. Thank you so much to all who support our important work!

—Tom Padham, Weather Observer & Education Specialist

6:40 PM Mon. June 8

The summit broke a couple records late last May during the most uneventful week I have experienced thus far. Having said that, even during an uneventful week, apparently, the summit of Mount Washington can still be quite eventful. When I say uneventful, what I mean is beautiful sunny weather, dry conditions, low winds, and a few fair weather cumulus clouds. Essentially, t-shirt and shorts weather, which is exactly what I was wearing during this week up.

Often times, the summit is unaffected by daytime heating processes due to the positioning of the boundary layer with respect to the summit. Just in case

you were wondering what the boundary layer is, the atmospheric boundary layer is the region of the lower troposphere that is heavily influenced by the surface of the Earth. The surface holds heat, radiation and moisture, and it also causes friction with any moving air mass. Flow within the boundary layer tends to be relatively turbulent compared to the statically stable layer of air or a temperature inversion. Sometimes you may even be able to spot a temperature inversion on our current summits page!

When the summit broke some of its daily and even monthly records, the boundary layer was likely above the summit, which allowed the summit to take advantage of diurnal heating with all that plentiful sunshine and lack of wind. This likely nudged the temperature up a few degrees, but was not the dominant factor. The big factor for the unseasonably warm and nice weather was actually the synoptic pattern that brought warm Gulf of Mexico and Continental air masses to the Northeast over several days. Take a look at the records that were set...

High temperatures:

26th: 62°F *(daily record; old record 59°F)*

27th: 66°F *(daily record, tied May monthly record; old daily record 63°F)*

28th: 62°F *(no records set; significantly more clouds and fog, but still warm)*

Also notable is that the minimum temperature on May 27 was a toasty 56°F, which set a new monthly record high minimum temperature (previous record 53°F). This makes the daily mean temperature of 61°F, which broke the previous warmest daily mean temperature for the month of May of 58.5°F on May 22, 1977 (in other words, Wednesday was the warmest May day on record). The 61°F is also just the 77th time since the 1st of Jan, 1935 that the summit has had a daily mean temperature ≥ 61°F (a less than once per year occurrence, all others occurring June — Sept.).

—Jay Broccolo, Weather Observer & Meteorologist

4:23 PM Mon. July 13

Today I led my first distance-learning program since being hired as the Education Specialist. After many days fine-tuning my presentation and rehearsing to others and myself today was finally the day! In some ways, preparing for this DL was much like preparing a lesson for a classroom. Two years of teaching definitely prepared me for this first step!

After creating the content, I had my presentation peer reviewed by colleagues. They were able to give me pointers on how to captivate the audience further and caught the mistakes I was overlooking. It's always good to have a second set of eyes (or even a

third) to overlook your work!

Once the presentation was set, I ran through the slides several times to solidify what I wanted to talk about for each one and made sure to keep it fun and entertaining! Some tips that I learned was to have an interesting background of a photo or video, not much text, and if possible use a prop! These tricks were things that I had noticed from my teaching days as well.

Once I felt that my DL program was perfect I rehearsed one more time and then I was set! This morning I refreshed a few key points and then it was time to put all of my hard work to the test. Today's program was one on "Extreme Weather Obs" where I featured how and why we take hourly weather observations. This program was for one of our sponsors, MathWorks! I walked my viewers through the instruments used in weather observation as well as some of the importance of being a manual weather station at 6288' elevation.

Once I pushed through the initial nerves of presenting in front of a (unseen) crowd through Zoom, I was back to my old habits of teaching what I am passionate about. I always found it so important to be passionate while leading classes. This energy is what connect to your students or participants and helps them get involved in the content you are conveying! I am very passionate about MWObs and our job up here on the summit and I hope that was shown through my DL!

I get to continue practicing these skills moving forward for my next program (tomorrow's program on Tropical Cyclones), as well as future programs like Science in the Mountains. I absolutely love to educate and to get people excited about weather and climate and hope that I influence my viewers through these DLs.

—Nicole Tallman, Weather Observer & Education Specialist

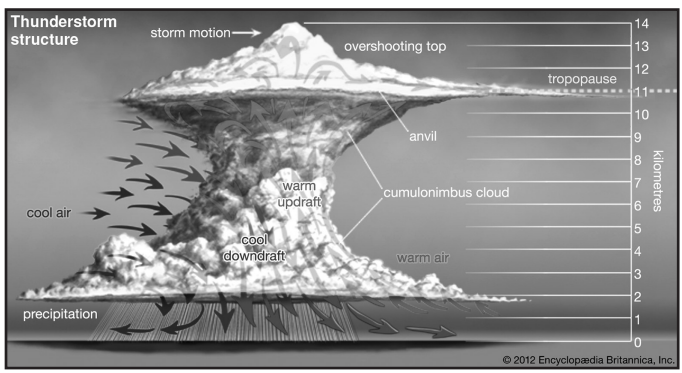
Downbursts

BY NICOLE TALLMAN

In early August, Tropical Storm Isaias caused damage and extreme weather to the East Coast including the Mount Washington Valley. Trees were downed, power was lost and unfortunately, there was a fatality. Many blamed the devastation on a tornado. However, more likely it was a downburst and more specifically, a microburst.

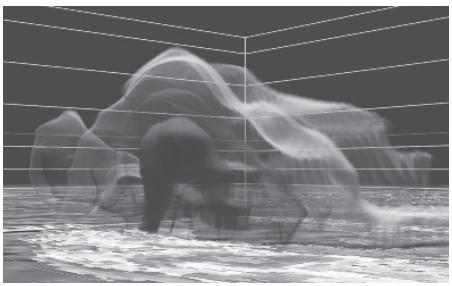
What is a downburst and how do they form? In order to answer that question, we must understand where downbursts come from: thunderstorms. Thunderstorms have three main ingredients: lift, instability and moisture. In order to begin the formation of a thunderstorm air has to rise. Some forms of lift are frontal, orographic, and thermal. Whether it be two air masses colliding in a front, mountains forcing air upward or the rising of hot air, each of these examples has air lifting higher into the sky. The second ingredient is instability. When air is rising it has many forces trying to keep it from rising. The air in thunderstorms is unstable meaning that when it begins to rise, it fights these opposing forces and continues to rise! Lastly, there needs to be moisture in the air in order for a cloud to form as the air rises. The higher in the atmosphere air goes, the cooler the temperatures. Cooler air cannot hold on to as much moisture as warmer air and therefore when air rises it will condense its moisture and form a cloud.

Now we will take a look inside of a thunderstorm to understand how a downburst begins to develop. Inside a thunderstorm there is a circle of rising hot air and falling cool air. The rising hot air is called the updraft and the falling cool air is called the downdraft. When air is very unstable or has enough lift it can form very strong updrafts. These updrafts will blow the liquid particles up high into the sky where the cold temperatures freeze the raindrops creating hail stones. Most of the time, raindrops and hailstones fall through the updraft and precipitate out of the cloud. However, sometimes the updraft is so strong that it will hold a pocket of precipitation high in the cloud. This "precipitation core" can even be seen on radar. Eventually the core becomes too



Thunderstorm anatomy showing the updraft and downdraft inside of a strong storm. Graphic from Brittanica.

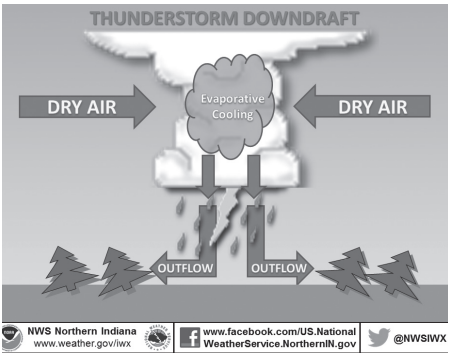
heavy for the updraft and will fall. The falling of a precipitation core can be one of the reasons why air is dragged down to the surface at a fast rate causing a downburst.



Precipitation core (darkest colors) held high in a strong thunderstorm due to a very intense updraft. You can see the precipitation reaching the ground in the left-hand side of the storm. Graphic from weather.gov.

Another contributing factor to downdrafts is the introduction of dry air to the storm. When dry air is brought in to the storm it causes some of the moisture to evaporate out of the cloud. Evaporation causes cooling of the air (think of sweat evaporating off your skin causing you to cool down). This cooling process will cool the air high in the cloud where the evaporation is occurring. Once there is enough cooling the air will sink because cool air is more dense than warm air. This air sinks down through the cloud and adds to the falling air in a downburst.

Not all downbursts are the same. Microbursts or macrobursts are certain scales of a downburst. Macrobursts will have destruction stretching about 2.5 miles away from the area of the downburst. Microbursts are smaller and are less than 2.5 miles of damage from the downburst. However, while the damage is more concentrated and they may be shorter lived, microbursts can form wind speeds of over 100 mph and can be very destructive. The damage formed by any type of downburst can be very similar to that of a tornado (trees down, power lines



A visualization of dry air being brought into a thunderstorm and aiding to the development of a downburst.

blown over, buildings destroyed) however, this destruction is not from rotating wind like in a tornado, it is from straight line wind being blown down and out of a thunderstorm.

Downbursts can have unique hazards depending on the type and location of the burst. Downbursts that occur in the West are most likely to be dry downbursts, meaning that any precipitation that was falling evaporated before it hit the ground. In these downbursts, wind is the main concern. In the East, wet downbursts are more common. These downbursts not only have the hazard of increased winds, but also will have the hazard of the falling precipitation core. Heavy amounts of rainfall, hail and winds can be very destructive to trees, property and humans if you are caught outdoors in it. Aircraft are also vulnerable to the hazards of downbursts and must be aware when there is a risk. The pocket of falling air or heavy precipitation is enough to disrupt landing and takeoff. Downbursts have even been observed on Mount Washington! These winds are surely enough to knock anybody off their feet if caught outside during it!

New Weather Observers Grace Summit

BY **REBECCA SCHOLAND**

What a whirlwind spring, summer, and fall we have had. Work and life on the summit have become very different this year. When I last wrote I spoke of the initial cancelation of our winter 2020 trips, and volunteer program. Since this time the cancelations have been extended. Extreme Mount Washington did not open for the season, the weather station did not open to the public, and we did not hire any Interns. In fact, these cancelations will extend into the 2020-2021 winter season. Despite all this change the new summit staff has risen to the occasion stepping in repeatedly to make sure the summit is progressing forward.

Since spring 2020, we have had a number of new faces join our team and said goodbye to a number of others. Observers Adam Gill, AJ Grimes, Tom Padham, and Ian Bailey all left the Observatory to pursue new adventures. In their place we hired David DeCou, Nicole Tallman, Nate Iannuccillo, and Sam Robinson. They all had the challenging role of learning, studying, and adapting to life on Mount Washington during a pandemic. However, I am thrilled to report that despite all the proverbial curve balls and challenges our new crew is rocking it! So without further ado, let me introduce our summit crew.

In February, after returning from a stint at Amundsen-Scott South Pole Station, Antarctica we welcomed David DeCou as our new Night Observer allowing Jay Broccolo to transition to the day shift. In June, former interns Nicole Tallman and Nate Iannuccillo joined us as our new Education Specialists and quickly had to adjust to being in front of the camera with our various remote programs in full swing. Finally, Sam Robinson joined the team with a background in mechanical engineering and passion for weather. Veteran Observers Ryan Knapp and Jay Broccolo continue to be our summit mainstays keeping us on track and supporting the quality training and control in all our hourly data. Ryan additionally contributes many of our images you enjoy on social media.

Needless to say I am proud of, and grateful for, the determination and dedication the summit crew has demonstrated these past few months. We're all looking forward to the wild weather ahead. I do also think it is important to talk about one other member of the summit crew that will be leaving us this upcoming winter.

After many years of service on the summit Marty the cat will be retiring. It's time he heads below treeline to

Nicole Tallman

Sam Robinson

Nate Iannuccillo

live out the rest of his days in a calmer environment. Still in great health we want to ensure he is closer to a veterinarian should he need it. As with past cats, he will be retiring with one of the New Hampshire State Park staff who loves him very much. Not to worry though, a new feline will return to the summit to take Marty's spot and continue the tradition. We just don't know who yet.

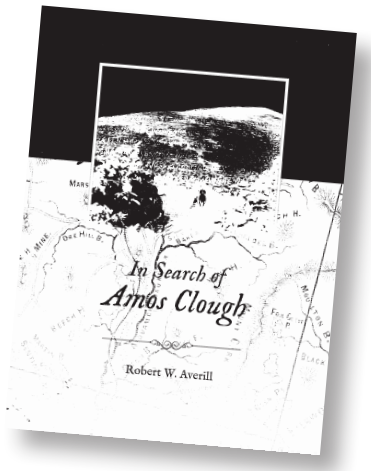
This brings us to the operations on the summit as we begin to turn the corner into winter. Preparations and service on the 4WD vehicles was completed in early September as well as work on the snowcat. This year we replaced several of the treads on each track. (A job that is both a bit time consuming and required several sets of hands.) Under Hardware Systems Specialist Pete Gagne's instruction, Information Systems Administrator Keith Garrett and I helped with this process and the snowcat was ready by late September. Knowing how quickly the mountain turns to winter conditions it is important for us to be ahead of the curve when it comes to transportation.

We are also focusing on getting our instruments ready for the winter months. It is always important to conduct maintenance and cleaning on items while it is still feasible to do in calmer weather. This includes scraping and repainting the Thermoshack, checking backup thermometers, cleaning heat shields on temperature probes, and other tower maintenance. If all is taken care of it helps our winter months run smoother. At the end of the day that's what we all hope for, so as we turn the corner into winter, we will be ready.

In Search of Amos Clough by Robert Averill

BY **PETER CRANE**

The winter of 2020-2021 brings the 150th anniversary of a remarkable event—the first winter occupation of Mount Washington's summit for scientific purposes. What better time to learn more about one of the participants in that endeavor, Amos Clough, pioneer White Mountain photographer. And what better way to learn about Clough than through a new book by White Mountain historian Robert Averill.



It was a century and a half ago this year that Charles Hitchcock and Joshua Huntington organized and carried out a winter-long expedition to the top of the Northeast's highest peak. Though geologists, they were intrigued by other aspects of earth science, including meteorology. And so they took upon themselves the challenge of learning more about Mount Washington's weather in its harshest season.

Among the members of the expedition was Amos Clough. Huntington and Hitchcock recognized the importance, for scientific and promotional purposes, of having their adventure visually documented, and Clough, they knew, was the photographer for the job. Clough had spent most of two months in the previous winter atop Mount Moosilauke, sharing that exploit with Huntington, and had proven himself a capable companion.

In his new book, "in Search of Amos Clough," Robert Averill explores the life and work of Clough, a not-well-known photographer who hailed from Warren, New Hampshire. Born of very humble origins, Clough was taken with the then-new art and science of photography. He captured scenes of life around Warren, and his enthusiasm carried him to the summits of the White Mountains in pursuit of his artistic expression.

Averill has done a remarkable job in uncovering some of the obscure details about Clough in his milieu, and includes the original version of Clough's Moosilauke journal. However, much of his life and work was barely documented and remains unknown, even for the most diligent researcher. The author has allowed Clough's work to speak for him, as the book features many, many examples of Clough's photographic work, from cartes de visite to a stunning array of Clough's stereoviews. Not only are scenes of valley life depicted, but all

of the discovered Moosilauke views, and many of the Mount Washington views, are included. The quality of the reproduction and printing is excellent. And—a special bonus—the book includes a simple stereoviewer, so that the reader can enjoy and appreciate the stereograph images in the manner for which they were intended.

Clough we know, was a generous man — he was willing to share his photographic experiences on Mount Washington with another photographer, Howard Kimball, of Concord. Following this example, Robert Averill has generously shared his many years of research into Clough and his work with us through this handsome volume. The author's enthusiasm for Clough is obvious and will without a doubt be embraced by his readers. Though, alas, Clough died less than two years after his Mount Washington adventure—still a young man. Averill's dedication to the task will help the memory of Clough and his work live on.

"In Search of Amos Clough" by Robert W. Averill. Warren, N.H.: Privately Published, 2019. Hardcover, viii+370 pages, lavishly illustrated.

FROM THE MESONET CORNER

Vehicle Maintenance Never Ends

BY **PETER GAGNE**

Maintenance is all consuming all the time.

This past year has been the most challenging I have faced in my ten years with the Observatory. Winter trip season was canceled midway through due to COVID-19, and new protocols were enacted to protect the summit staff. In addition to Mesonet and transportation duties, I also inherited facilities management, which includes three buildings and a fleet of five vehicles. So for me, spring and summer were, needless to say, extremely busy juggling so many bowling pins.

Our 4WD truck and 2WD van both needed to go into the shop at Albany Service Center. Alan Valladares and his trusty crew repaired the rusted frame on the van and replaced rusted and broken exhaust manifold bolts on the truck. We got new tires for the truck after replacing the van's tires last year and our 4WD van passed New Hampshire state inspection without problem which was reassuring. Chains were checked out for the shoulder icing seasons of fall and spring so all set to go there I'm happy to report. And one of life's simple pleasures, but also an absolute necessity for safe mountain travel, we got new windshield wipers! On Mount Washington, with its inclement, unpredictable weather, visibility is everything, and there is nothing more annoying than worn-out wiper blades.

Information Systems Administrator Keith Garrett and Summit Operations Manager Rebecca Scholand worked hard to get the snowcat into shape for this winter.

The snowcat spent the summer in our maintenance garage with tracks and wheels off as we had to replace six of the ten rubber drive belts. One of the belts actually broke at the end of the season last winter. Fortunately, it happened on the very last trip before the Mt. Washington Auto Road became passable to the summit with the van and truck. Excavating business owner Lee Corrigan of Berlin brought his flatbed to haul the snowcat down to the garage, and Information Systems Administrator Keith Garrett, Summit Operations Manager Rebecca Scholand and I put many hours into the job.

Each belt is bolted to the sixty-eight steel grousers with three bolts each, for a whopping total of 1,020 bolts! And each bolt must be hand-tightened using a torque wrench (to 45-50 Lb/Ft, for those interested). Each and every bolt was marked with a Sharpie to ensure not a one was missed. It took two solid weeks just to replace the belts. Then the sharp "picks" that grip the snow had to be checked and the worn ones replaced. And each of the ten tires were removed, hubs disassembled in order to inspect the wheel bearings, reassembled and tightened to the proper torque, tires reinstalled and lug nuts again tightened to the proper torque.

Finally, just like your car, all filters and fluids were changed, levels checked, batteries charged. Last, the tracks were reinstalled with the assistance of the Auto Road crew and their loader.

I'm sure this winter will present its share of transportation challenges as it always does, but heading into it knowing that your equipment is properly maintained and ready to go is paramount to a safe travel season.

Observatory Maintains Significant Research Projects During Trying Times

BY **BRIAN FITZGERALD**

Although the summit weather station spent most of this past year insulated from the public, the scientific work of the Mount Washington Observatory's curious staff and project partners carried on. As is typical, MWO is usually engaged in a number of product testing, hosted and original research projects happening simultaneously.

This past summer biologists from New Hampshire Fish and Game returned for a second consecutive summer to continue the vital investigations into the White Mountain Fritillary *(Boloria chariclea montinus)*, a state priority species that is only found in snowbank communities above tree line in the Presidential Range of the White Mountains. Biologists with Fish and Game used Observatory lab space to investigate some very basic questions about the species, including what these insects eat, how big is their population, how may it be changing, and even how do you identify a male from a female butterfly. Findings from this work may ultimately lead to answering whether or not these endemic species should be listed on the Federal Endangered Species List.

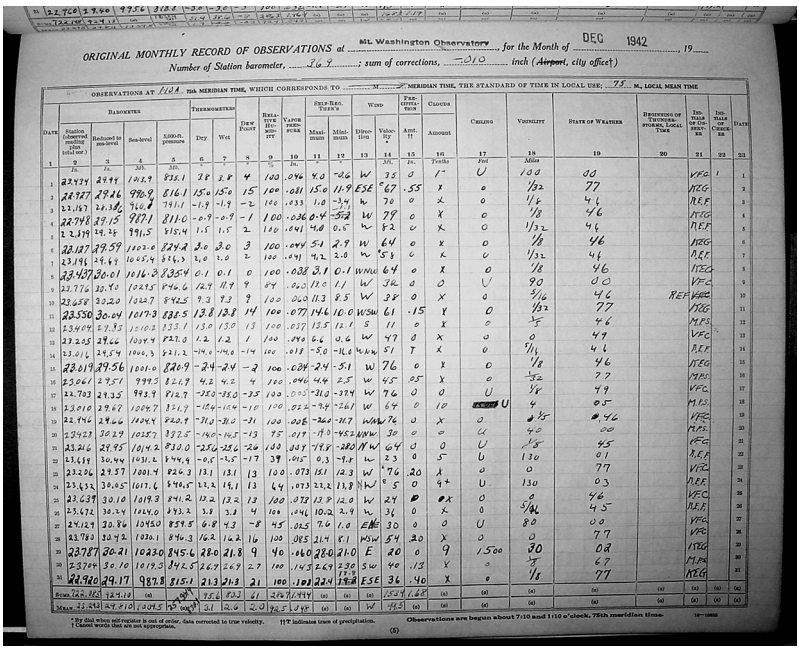
In the realm of product testing MWO reached an agreement with the Federal Aviation Administration to help evaluate how different anemometers perform in extreme icing conditions this winter. This evaluation is directly linked to work ongoing at the Juneau Airport Wind System, also known as JAWS. This frightfully named program is a network of weather stations that record wind measurements around Juneau, Alaska's airport known for terrain-influenced turbulence during aircraft takeoff and landings. The JAWS program helps controllers at the airport understand and communicate go/no-go parameters for aircraft safety. Interestingly enough, significant wind speeds and icing occurs frequently at one of the JAWS stations located atop Sheep Mountain (4,238 feet), perched prominently above the Pacific Ocean. Given Mount Washington's frequency of these similarly challenging conditions, it's not a coincidence that MWO and the FAA have linked up again as we have in the past to help evaluate aviation safety equipment.

MWO is also currently engaged in significant original climatological research. Beginning last October, staff at MWO have been deeply involved in the colossal task of developing a "research-grade" temperature database meant to encourage greater access to and homogeneity in MWO's climate record. Since 1935 temperature data has been collected nearly every single hour with few exceptions, and through the process

of digitizing these records a number of challenges in analyzing these data have been discovered over time. While instrumentation and locations have barely changed over an 80-plus year record, standard operating procedures related to when daily maximum and minimum temperatures were reported shifted. With the discovery of these inconsistencies, there stands a significant opportunity to quality check the entire temperature record and conduct an updated analysis of the climate record since Grant et al. in 2005.

In order to get to a place where MWO can put its full confidence behind a "research-grade" temperature database, a massive data verification effort has been needed to confirm that our original paper records match our digital database. This effort has meant dedicating hundreds, if not close to thousands of hours from a hand full of valley and summit staff to painstakingly verify every hourly and synoptic temperature value since 1935. This roughly adds up to checking approximately one million temperature values for accuracy.

Needless to say, setting up a new temperature database will be an incredible achievement for our staff, but also the broader scientific community. The methods and approach taken in this project will also be a tremendous benefit to analyzing other historic climate datasets throughout the world. At the time of writing this in September, the temperature database project is in the final stretches; however, expect to hear more about the outcomes of this project


ORIGINAL MONTHLY RECORD OF OBSERVATIONS at Mt. Washington Observatory, for the Month of DEC 1942

Countless paper forms such as this one from December of 1942 have been checked to verify temperature records that currently exist in the Observatory's digital database.

in the very near future. With the completion of the temperature database project, MWO research efforts will focus on other aspects of the summit's unparalleled climate record, including a shorter data exploration and analysis of historic visibility data on the summit.

Daily weather observations are made at NCON3 on Pine Street in North Conway.

Last but certainly not least, MWO continues to support climate recording in more than one place in our region. Beginning in 1959 MWO founder Joe Dodge began recording weather observation for the National Weather Service's Cooperative Observer Program (COOP) at his home on West Side Road in North Conway. Briggs Bunker followed Dodge making daily observations a short distance away on Pine Street, from 1974 until 2006. Ed Bergeron continued making daily observations at his home on West Side Road until October 2015 when a station (named "NCON3") on Pine Street in North Conway was commissioned on October 7, 2015. Now observations of rain, snow and temperature as well as visibility, sky cover and ground conditions are made every morning at 8 a.m., 365 days a year by MWO staff and volunteers, ensuring the climate of Mount Washington Valley is properly recorded. Until recently, this data may have been somewhat hard to find, but starting this fall the Observatory's website has added a NCON3 webpage complete with a link to current conditions at the site along with historical monthly summaries. Be sure to give the page a visit!

Thank you to all of you who support research and discovery at Mount Washington Observatory, and please do not hesitate to reach out with any questions to research@mountwashington.org if you have any thoughts or questions.

Observations of snow, rain, temperature, sky conditions and more are made by staff and volunteers at the Pine Street weather station.

Curtailed Volunteer Program Continues On

BY **LINDA AND HANK DRESCH**

As we write this article in early September, meteorological fall has arrived, and the temperature doesn't know what to do. We've experienced overly warm and humid days, followed by very cool and dry ones; then it flips again. However, the trees are beginning to show some color. The North Country is also in the midst of a prolonged drought with longtime residents commenting that they have never seen the rivers so shallow nor gardens so dry.

The Valley Volunteer program has had to be curtailed in response to the COVID-19 concerns. Seek the Peak thank you letters and the summer membership mailings have been handled by your coordinators. Gratefully, Linda Denis and Kim Henry were given permission to assist with the September mailing.

With Seek the Peak going virtual, Valley Volunteer support wasn't needed. However, we created a Valley Volunteer Seek the Peak team. Thank you, team members, for your financial contributions.

Despite the pandemic, our volunteer gardeners Barbara Althen and Bill Ofsiany, occasionally aided by Donna Gray and Peter Crane, along with your coordinators and grandson Nate Livingood, kept the Weather Discovery Center grounds in excellent condition. We were hoping to have a fall cleanup, and are looking forward to future membership mailings with our Valley Volunteers while sharing COVID-19 experiences.

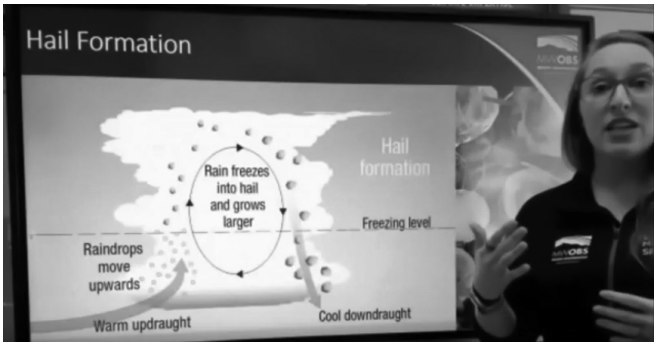
Helping hands ensure blooming gardens at the Weather Discovery Center.

Finally, we would be terribly remiss at this point if we did not stop and take note that two of our longest serving volunteers reached a major milestone in September. Happy 90th birthday Bill Housum and Floyd Carson!

Despite our reduced activities we appreciate our volunteers who helped and/or participated in the Valley Volunteer STP Team. These folks include:

- Barbara Althen
- Peter Crane
- Marietta & Bob Deegan
- Linda Denis
- Linda & Hank Dresch
- Peter Fisk
- Karen Franke
- Shirley & Phil Gravink
- Donna Gray
- Kim Henry
- Joan & Sandy Kurtz
- Nate Livingood
- Judy Meagher
- Dennis Maiorino
- Bill Ofsiany
- Jean Sweeney

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



SCIENCE IN THE MOUNTAINS

Science in the Mountains, supported by MathWorks, is the Observatory's free virtual year-round lecture series. Learn about the climate, weather and other amazing topics from home. Observatory staff, along with experts, allow you to expand your scientific knowledge through lectures that encourage questions from participants. All programs start at 7 p.m. and use both Zoom and a live stream from the Observatory's Facebook page. Can't make one? That's okay because they are recorded and available the next day on the Observatory's YouTube channel. Registration is recommended. Find out the schedule on the Observatory's web site mountwashington.org.

SUMMIT TRIPS

Due to the COVID-19 pandemic, snowcat trips to the summit— both day and overnight EduTrips—are not being offered. Neither are partner-led climbing trips. Please check the Observatory's web site mountwashington.org for updates.

21ST ANNUAL SEEK THE PEAK JULY 2021

Planning for the Observatory's largest annual fundraiser is underway. We expect registration to begin near the end of 2020. To learn more about becoming an event participant, sponsor, or volunteer, go to seekthepeak.org

FREE DISTANCE LEARNING

Free distance learning programs are available each week to support educators in their vital need for virtual classroom programs every Monday at 11:15 a.m. through May, 2021. Students and weather enthusiasts can connect live to Mount Washington as Weather Observers and Education Specialists at MWO present via Zoom in 30 minute sessions called "Home of the World's Worst Weather Live." Program content will cover topics including weather, climate and climate change through the context of Mount Washington and the Mount Washington Observatory. Live programs will be uploaded to MWO's website at mountwashington.org/classroom for use outside the regularly scheduled time.

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Member Milestones —50 Years

BY STEPHANIE FITZGERALD

This winter, seven of you will celebrate 50 years of membership with us. Joining in 1971, this group has continuously made donations to our non-profit, showing their support for our work in weather and climate science for the last five decades.

We often see a connection between our members and the hiking community, as many who head into the White Mountains quickly realize how unique the weather is on Mount Washington and the higher summits. A few in this group shared a love of the outdoors and specifically the Appalachian Mountain Club's Lakes of the Clouds Hut. MWO Life Trustee Chris Hawkins of Randolph, N.H. and member Tim Saunders of Wellesley, Mass. both worked at Lakes either for Joe Dodge or as part of the Hut Croo. Mike Hansen of Cambridge, Mass. still remembers staying at Lakes as a young teenager. He hiked to the summit and experienced low temperatures cold enough that he had difficulty getting his fingers to zip up his jacket even though it was the middle of summer. We are grateful so many in the hiking community recognize and appreciate the work that we do and have done over the years and that many of them turn into MWO's lifelong supporters.

I am delighted we are able to recognize this group of 50-year members this issue. It is because of them and members like you that our Observers have continued to work on the summit, recording data and battling extremes, for nearly 90 years. Thank you! Questions about your membership? Email me at sturnbull@mountwashington.org.

50 Years...

C. Richard Carlson
Mike P. Hansen
Chris Hawkins
Peter Lindenfelser
William Bentley
Timothy K. Saunders
Dorothy A. Bean

GREEN FLASH

Shot in the Dark

Comet NEOWISE was a sight to behold in July as it streaked across the night sky. Discovered in late March and named after NASA's Near-Earth Object Wide-field Infrared Survey Explorer, the comet put on a scintillating show in the northern hemisphere. According to NASA, it won't be visible again for another 6,800 years.

Observer Ryan Knapp captured the streaking comet on July 13 (among other nights) as it tore across the sky above the summit of Mount Washington sometimes under the flickering Northern Lights. "It was early to spot and photograph earlier in the month," Knapp said. "It certainly got dimmer and much harder to see as the month went on."

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Join us via Zoom* or Facebook/MWObs
Varying Tuesdays
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Visit mountwashington.org/SITM for program updates and to register today.

The Zoom call has limited space available.
If you are unable to attend via Zoom please join us on at Facebook/MWObs for the live presentation.

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