2020 Shareholders Report

National Weather Service
Austin/San Antonio

Welcome to the Inaugural Edition of the NWS Austin/San Antonio Shareholders Report

The past few months have been challenging as we continued to endure the pandemic while delivering our weather and water mission to the citizens of South-Central Texas. Despite these challenges, our focus and goal were to serve you with the best forecasts and warning services for all 33 counties in our area of responsibility.

As a further extension of our service, we are pleased to present the inaugural edition of the National Weather Service (NWS) Austin/San Antonio Shareholders Report. This report will be a conduit through which we can present and communicate details of weather-related activities and current events, and meteorological information of interest. To that end, we will be publishing our Shareholders Report semi-annually with weather stories, factoids, local weather office projects, and reviews of significant weather impacting South Central Texas – the Heart of Texas.

I hope you will find this and future Shareholders Reports informative and of interest. Our goal is to better serve you, our shareholders, by keeping you updated on weather-related information from across our area. We welcome your feedback on how we can improve our newsletter and services to you.

NWS Austin/San Antonio in New Braunfels, TX

-Joe Arellano
Meteorologist in Charge

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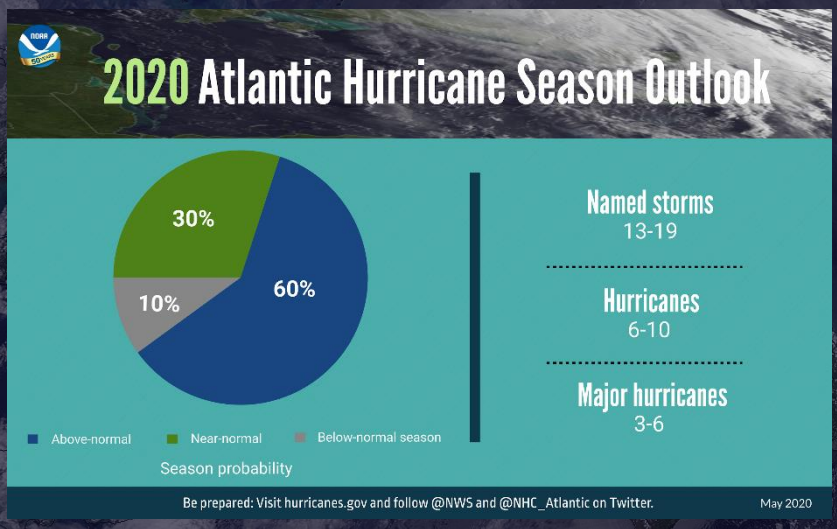
Active Tropical Season Forecast for the Atlantic Basin

By: Jason Runyen, Lead Meteorologist

While the official start of the Atlantic tropical season is June 1st, in some years tropical systems have developed before this date. The 2020 season got off to a fast start with Tropical Storms Arthur and Bertha developing in May. Tropical Storm Cristobal formed on June 2nd. According to Phil Klotzbach, Research Scientist for the Department of Atmospheric Science at Colorado State University, this is the earliest date on record (since 1851) for a third named storm in the Atlantic basin. The old record was Colin on June 5, 2016.

While the official hurricane season runs June 1st through November 30th in the Atlantic basin, it's important to note that on average 2/3rds of all hurricanes in the Atlantic Basin form after August 28th, and ½ form after September 9th. Over 90% of all major hurricanes (Category 3-5 on the Saffir-Simpson Hurricane Wind Scale) have occurred from August through October.



An above-normal 2020 Atlantic hurricane season is expected, according to forecasters with NOAA's Climate Prediction Center, a division of the National Weather Service. The outlook predicts a 60% chance of an above-normal season, a 30% chance of a near-normal season and only a 10% chance of a below-normal season.

The forecast calls for 13 to 19 named storms (winds of 39 mph or higher), of which 6 to 10 could become hurricanes (winds of 74 mph or higher), including 3 to 6 major hurricanes (category 3, 4 or 5; with winds of 111 mph or higher). An average hurricane season produces 12 named storms, of which 6 become hurricanes, including 3 major hurricanes.

"NOAA's analysis of current and seasonal atmospheric conditions reveals a recipe for an active Atlantic hurricane season this year," said Neil Jacobs, Ph.D., acting NOAA administrator.

It's important not to focus too much on seasonal outlooks as it only takes one bad storm to impact a community forever. Also remember that one should not focus solely on the category of a storm. The category of a storm does not indicate risk and impacts from flooding rain and tornadoes, historically the two biggest threats inland across South-Central Texas. Our region has experienced some of its biggest floods from "weaker" storms. Some examples of catastrophic flooding from systems that weren't hurricanes include:

- 48 inches of rain over 3 days in Bandera County from the remnants of Tropical Storm Amelia in 1978
- 43 inches of rain in just 24 hours in Alvin from Tropical Storm Claudette in 1979
- Over 30 inches of rain in parts of Houston from Tropical Storm Allison in 2001
- Over 19 inches of rain in Del Rio, most of it in just 4 hours, in Del Rio from the remnants of Tropical Storm Charlie in 1998.

Historical Tropical Cyclone Rainfall Producers in Texas

- **Hurricane Harvey (2017) – 60.58" in Nederland, TX**
  - U.S. Tropical Cyclone Rainfall Record
  - 65 flooding fatalities / $125 billion in damage
- **Tropical Storm Amelia (1978) – 48" near Medina, TX**
  - 4th Wettest U.S. Tropical Cyclone / 33 flooding fatalities
- **Tropical Storm Claudette (1979) – 45" in Alvin, TX**
  - 42" in 24 Hours - U.S. 24 Hour Rainfall Record until 2018
  - 6th Wettest U.S. Tropical Cyclone
- **Tropical Storm Imelda (2019) – 44.29" in Jefferson County, TX**
  - 7th Wettest U.S. Tropical Cyclone / 5 flooding fatalities
- **Tropical Storm Allison (2001) – 40.68" in Jefferson County, TX**
  - 9th Wettest U.S. Tropical Cyclone / 41 flooding Fatalities
- **1921 Hurricane – 39.71" in Thrall, TX**
  - 36.4" in only 18 hours / 215 flooding fatalities
- **Hurricane Madeline (1998) – 28" near New Braunfels, TX**
  - Remnants of Pacific hurricane assisted in heavy rainfall / 31 flooding fatalities
- **Hurricane Beulah (1967) – 27.38" in Pettus, TX**
  - Record flooding on the Nueces and San Antonio Rivers
- **Tropical Storm Charlie (1998) – 19.05" in Del Rio, TX**
  - Rainfall occurred in only 4 hours / 13 flooding fatalities

Inland Flooding is the Leading Cause of Fatalities from Tropical Cyclones in South-Central Texas

As with every hurricane season, the need to be prepared is critically important this year. “Social distancing and other CDC guidance to keep you safe from COVID-19 may impact the disaster preparedness plan you had in place, including what is in your go-kit, evacuation routes, shelters and more. With tornado season at its peak, hurricane season around the corner, and flooding, earthquakes and wildfires a risk year-round, it is time to revise and adjust your emergency plan now,” said Carlos Castillo, acting deputy administrator for resilience at FEMA. “Natural disasters won’t wait, so I encourage you to keep COVID-19 in mind when revising or making your plan for you and your loved ones, and don’t forget your pets. An easy way to start is to download the FEMA app today.”

To stay up to date during the hurricane season follow trusted sources such as hurricanes.gov.

You can also find local information on our local tropical webpage here.

Constitution for Personal Flood Safety

By: Jon W. Zeitler, Science and Operations Officer

It's been quite a while since the last widespread flood event in South Central Texas. The recent start of the 2020 Hurricane Season is another reminder that now the time to prepare for the next flood. While there are many ways to prepare, the Preamble of the U.S. Constitution:

"We the People of the United States, in Order to form a more perfect Union, establish Justice, insure domestic Tranquility, provide for the common defence, promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this Constitution for the United States of America"

offers an easily remembered mnemonic, and call for a commitment to personal flood safety. Here is a look at how to apply each of these five principles:

1. Establish Justice

Floods happen across our entire area, can occur in all seasons, and range in time from flash floods lasting a few hours, to mainstem river floods lasting for weeks. While federal, state, and local governments work on flood safety through the National Weather Service, emergency management, and first responders, establishing justice means it still comes down to each person's choices and actions for their own flood safety. While floods are beyond our control, having a mindset to be prepared can relieve fear and greatly reduce the threat to life and property.

2. Insure Domestic Tranquility

The largest financial asset for most people is their home, in addition to the emotional tie of it being the center of family life, neighborhood, and community. Thus, protecting one's home is important. The irony is *most homeowners' insurance policies do not cover flood damage*. However, supplemental flood insurance is available through the National Flood Insurance Program (NFIP). This program is administered by the Federal Government, but available through regular insurance agents. More than 25 percent of NFIP claims come from homes outside flood plains — meaning those people received a substantial benefit for a small cost. There are also private flood insurance programs, which may save even more money for those homes not in established flood plains.

3. Provide for the Common Defense

Even with flood insurance, repairing flood damage takes time and effort. There are simple, low-cost ways to prevent or minimize damage and the disruption of normal activities caused by flooding. For example, if water starts to enter your home, shutting off the power at the main circuit breaker will prevent appliances from short-circuiting, and also eliminate the threat of electrocution to those in the home. Similarly, outside air conditioning units can be raised on platforms above ground level. Further information on floodproofing can be found at the Federal Alliance for Safe Homes (FLASH) and FEMA Homeowner's Guide to Retrofitting.

4. Promote the General Welfare

The Turn Around Don't Drown® (TADD) program has reduced the numbers of those dying in, or requiring rescue from, flooded vehicles. In addition, events such as Tropical Storm Allison and Hurricane Harvey have shown people are safer staying at their current location unless specifically told to evacuate or if flood waters enter the building, rather than risk driving in floodwaters. However, the true success rate of TADD is unknown, and continued mortality and rescues during floods indicate the message of avoiding flooded roads is still not completely effective. Therefore, a higher level of flood avoidance and community responsibility should be considered, such that first responders (police, fire/rescue) lives are not put at risk rescuing people whose vehicles stalled or were swept away by flood waters. This is doubly important, as first responders assisting stranded motorists are not available to evacuate those needing special assistance or for medical emergencies.

5. Secure the Blessings of Liberty

Many possessions are replaceable, but a few special items are not. Flood victims often state they wish they had saved pictures, important documents (e.g., a marriage license), collectibles, and family heirlooms from floodwaters. In many cases they didn't have the means nor the time to transport the valuables to safety. A simple solution to save these valuables is to buy plastic containers with locking tops. These containers allow one to organize and protect valuables, then be put out of floodwaters' reach (in the attic or evacuated with the people). Home improvement, hardware, and discount stores carry the containers, with prices ranging from $5 to $50 each. Regular storage of valuables in the containers greatly reduces the amount of time it takes to move them, or the need to move them at all if stored in a high place such as an attic.

In summary, floods are greatest threat to life and property in our area. By remembering the preamble to the Constitution and applying its basic principles, nearly all of the financial risk, and most of the threat to life can be eliminated beforehand.

The Service Life Extension Program for the WSR-88D Radars

By: Aaron Treadway, Lead Meteorologist

Weather radars are a critical tool used to monitor precipitation and severe weather across a large area. The data from these radars is used by National Weather Service meteorologists to issue life-saving warnings, by TV meteorologists to point out storms in their viewing area, and probably by you on your phone to see if you will get rained on when leaving the house. Everyone takes the data displayed as greens, yellows, and reds for granted, but the country's WSR-88D radar network is now over 25 years old. The Central Texas trio of radars - KEWX (in New Braunfels), KDFX (in Brackettville), and KGRK (in Granger) - were all installed in the mid-1990s and designed to last 20 years. You do the math! These radars were already operating longer than their initial life expectancy and were in need of their recent hardware face lift.

The Service Life Extension Program (SLEP) is an ongoing eight-year project, with an $135 million price tag funded through a partnership between the National Oceanic and Atmospheric Administration (NOAA), the Federal Aviation Administration (FAA), and the United States Air Force. The project consists of four improvements to be completed on all of the country's 160 weather radars. These are: (1) replacing the signal processor, (2) updating the radar transmitter, (3) replacing the radar pedestal with a refurbished one, and (4) replacing the power generator. These improvements will extend the life of the radars another 15 to 20 years.

The first of these steps took place for the Central Texas radars in January of 2018 when the old technology within the signal processor was replaced. This improved the processing speed, data quality, and security of the processor. The signal processor is the part of the radar that takes the raw data from the radar signal and begins to differentiate between clutter and the actual targets (precipitation, hail, bats, debris).

The second step was to update the radar transmitter. The transmitter is the source for the radar pulses that are sent out and then bounce back once they hit a target. These upgrades that took place in January of 2019 added new fuses to the transmitter and replaced the original wiring that dated back to the radar installation in the mid-1990s.

The New Braunfels, TX Radar Dome Being Removed

The third, and most recent improvement, took place in January and February of 2020. For each of the Central Texas radars, the radar dish was disassembled, the dome removed, and the pedestal (the part that the radar turns on) was replaced with a refurbished one. The pedestal contains two large gears, the bull gear which helps rotate the radar and the azimuthal gear which controls the angle of the radar dish itself. The refurbished pedestal that KEWX (New Braunfels Radar) inherited was the one from the Omaha, NE radar. The process of lifting off the dome, swapping out the pedestals, and replacing the dome took roughly eight hours from start to finish.

The New Braunfels, TX Radar Pedestal is Lifted into Place

The fourth and final step has yet to be scheduled for any Central Texas radar. Each radar site has its own backup generator that will keep the radar functioning in the event of a power outage. The final step will replace the generators and clean out their fuel tanks.

In addition to the hardware changes that have taken place over the last three years to extend the life of the radar, the NWS Radar Operations Center continues to provide software updates that improve radar operations and allow for better detection of radar targets. This improved software technology allows for faster and more accurate detection of hail, tornado rotations and debris, and other radar targets that help improve National Weather Service warnings. Some of these software improvements are covered in the table below.

One final note about the third step in the SLEP process is the fact that while the early 2020 project was the first time the dome had been removed from the KEWX radar (pictured earlier) since it was installed, February 2020 marked the second time the dome had been removed from KDFX, the Laughlin Air Force Base WSR-88D located in Brackettville (near Del Rio). On May 25, 2001 baseball-sized hail and winds of 80 to 100 mph combined to damage the dome of the KDFX radar (pictured left). Although there was minimal damage to the radar dish and pedestal inside the dome, the damaged dome itself was removed and a new one was assembled around the radar dish.

Damage to the KDFX (Bracketville, TX) Radar Dome in May 2001

Timeline of Software Improvements to the Central Texas WSR-88Ds		
Year	**Title**	**Description**
2011	AVSET	Automated Volume Scan Evaluation and Termination stops the radar scan early if no echoes are detected at a certain elevation, thereby saving time between scans.
2012	Dual-Polarization	Dual-Polarization introduced products like Correlation Coefficient, Differential Reflectivity, and Specific Differential Phase which all help identify the shape, size, and changes in the radar targets, thus assisting in hail, heavy rainfall, and tornado detection.
2013	SAILS	Supplemental Adaptive Intra-Volume Low-Level Scan allows for up to three scans of the lowest radar tilt (0.5 degrees) within each volume scan, resulting in improved detection of lower level circulations.
2018	New VCPs	New Volume Coverage Patterns allow the radar to transition more seamlessly from clear air/non-precipitation mode into precipitation mode. These new scanning instructions also improve detection of non-precipitation targets like birds, bats, and features such as fronts and other wind boundaries.
2019	MRLE	Mid-Volume Rescan of Low-Level Elevations rescans at the 0.5, 0.9, 1.3, and 1.8 degree tilts. This allows the radar to see the middle of thunderstorms more quickly and improves detection of descending hail cores and mid-level rotations that could lead to tornadoes.

Winter/Spring 2020 Weather Events

By: Keith White, Meteorologist

The first half of 2020 is nearly over, and we've already had our fair share of interesting weather in south-central Texas! Here's a quick look at a few of the events we've experienced:

February 5th Austin Area Snow

A number of factors came together just right to produce snow in the Greater Austin area on February 5th. For an hour or two shortly after sunset, the sky opened up with fluffy flakes, turning the area into a giant snow globe and a scenic evening for many who may have never seen snow in their lives! A dusting to about a half inch of accumulation fell in Bastrop, Travis, and Williamson counties, but snowflakes mixed in with rain and sleet occurred as far south as Universal City and the area around Sea World in San Antonio. Satellite images showed it only took a few hours for the sun to melt it all away on the morning of the 6th. Interestingly, the snow left a thick coating of dust on cars. This is because hydrometeors (raindrops and snowflakes) require small particulates for water vapor to condense on in order to form, and in this instance the snow developed on dust blown northeastward from Mexico into the area.

Satellite Image of Snow Early February 6th

Snow in Bastrop early on February 6th

April 11-12th Del Rio Hail and Hill Country Tornadoes

On the evening of April 11th, a powerful supercell thunderstorm crossed the U.S./Mexico border at Del Rio and produced giant hail. The largest hailstones were measured at four inches in diameter, about the size of a softball! Although the supercell later dissipated before it reached San Antonio, additional thunderstorms developed overnight and caused two EF-1 tornadoes. The first was on the ground for 16 minutes in Gillespie County, with maximum winds estimated at 100 mph. A second touched down in Blanco County, then moved north into Burnet County 11 minutes later, producing maximum winds near 90 mph.

Del Rio Hail April 11th Photo: Joe Frias

Although 19 RVs, campers, and residences were severely damaged or destroyed by the second tornado, no fatalities were reported and there were only two minor injuries. Straight line winds also caused notable damage near Castell in eastern Llano County overnight.

April 12th Tornado Scouring near Willow City Photo: Janet Rabke

Late May Hailstorms and a West Bexar County Tornado

During a particularly active stretch of weather from May 24th through 28th, numerous rounds of thunderstorms brought all severe weather hazards to the region. On the 24th, a thunderstorm developed over Austin and dumped 1 to 1.5” hail over southern portions of the city around 6 pm, followed by a second storm bringing 1 to 1.25” hail over the same locations a little more than an hour later! Other locations saw more than three inches of rain in less than three hours, leading to some minor flooding. Further southwest, storms produced 70 mph wind gusts as they first moved through Hondo, and then caused straight-line wind damage and local flooding in Bexar County, as well as an EF-1 tornado (maximum wind speeds of 100 mph) in the Wildhorse subdivision.

Just two days later on the 26th, thunderstorms produced 1.25” hail over eastern Bexar County, then strengthened as they moved south and dropped 1.75” hail as they crossed into Wilson County. At the same time, hail up to 2” in diameter was reported over in Lee County. Not to be outdone, the very next night another complex of thunderstorms brought yet more hail to the San Antonio area around 9 pm, with tennis ball-size (2.5”) hail only three miles south of where the tornado had torn through just three evenings prior. Earlier that evening, a storm over Kerrville dropped so much small-to-medium hail that it looked like it had snowed! And after most of the thunderstorms had cleared the area, one last cell developed over Williamson County and dumped 2 to 2.75” (up to baseball-size) hail over portions of Georgetown just after midnight on the 28th. There were still more thunderstorms that afternoon, thankfully remaining tamer and more spread out, however there was still one more round of 1.5” hail in Kerr County before conditions finally calmed down to round out the month.

May 24th Tornado Damage West Bexar County

Science Corner: How Does Hail Grow?

By: Nick Hampshire, Lead Meteorologist

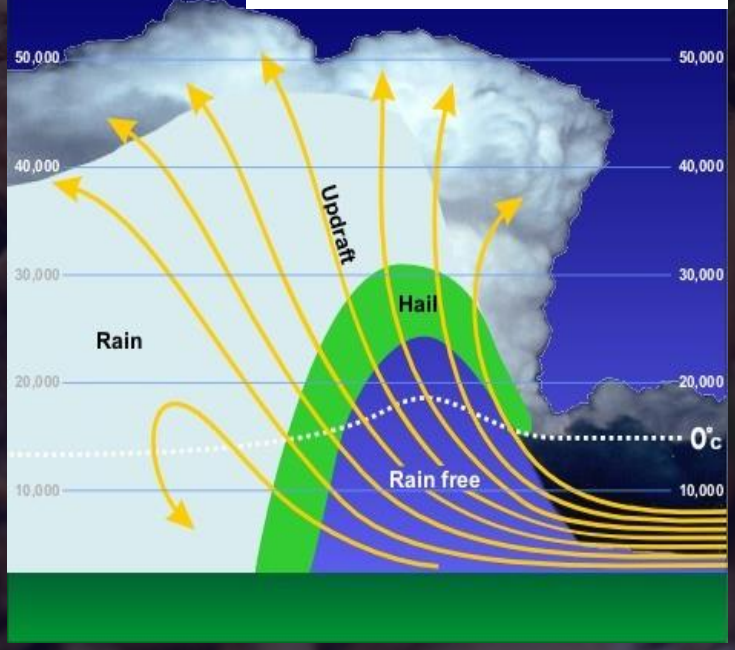
The Spring severe weather season brought several rounds of large hail to South-Central Texas with hail up to 2.5” in diameter reported in San Antonio in late May. Have you ever wondered how hail forms or how a thunderstorm can keep a large piece of solid ice suspended in a cloud for a relatively long period of time?

Every thunderstorm has two components within the storm, the updraft (air moving up) and downdraft (air moving down). Within strong to severe thunderstorms, these features of the storm are separated from one another. The base of the updraft is rain free, but as the air rises, the air molecules condensate and become water droplets. As these water droplets encounter air well below freezing they then freeze. These small hail stones then grow in size as supercooled water drops (liquid drops within an airmass below freezing) collide with the frozen hailstone and freeze instantly increasing the size of the stone.

As the hailstone becomes larger and larger, one would imagine that the weight of the stone would allow the hail to fall to the ground. However, in severe thunderstorms, the updraft is so strong it forces the hail stone to remain suspended in the highest levels of the thunderstorm, allowing it to keep colliding with additional supercooled water droplets which grows the stone even further. Eventually, the hail stone does become too heavy for the updraft to support it or the upper level winds blow the hail stone out of the updraft portion of the thunderstorm and into the downdraft portion and the hail then falls to the ground. For a hail stone about the size of a pea, the thunderstorm updraft has to be moving upwards at a speed of nearly 40 MPH for the stone to remain suspended. This speed increases to nearly 80 MPH for a quarter-sized (1”) hail stone, to 100 MPH for a golf ball-sized (1.75”) hail stone and up to 165 MPH for a softball-sized (1.75”) hail stone!

Here is a quick experiment to visualize a suspended hail stone within the thunderstorm updraft. You’ll need a ping pong ball and a hair dryer. Turn the hair dryer on and point dryer up to the ceiling. The air coming out of the dryer is your updraft. Next place the ping pong ball within the air flow and see how long you can keep the ball suspended in the “updraft” before your “hail stone” falls to the ground!

Schematic of a Thunderstorm



Automated Radiosonde Observing System

By Ethan Williams, Meteorologist

The Automated Radiosonde Observing System (AROS) is an automated weather balloon launching system we installed at Del Rio, in January 2020. The system is key to understanding the vertical changes of temperature, pressure, humidity, and wind. In addition, the data provide a starting point for our computer models and a way to quality control satellite observations. AROS was tested in Alaska over the past few years, and Del Rio is the first site in the Continental United States.

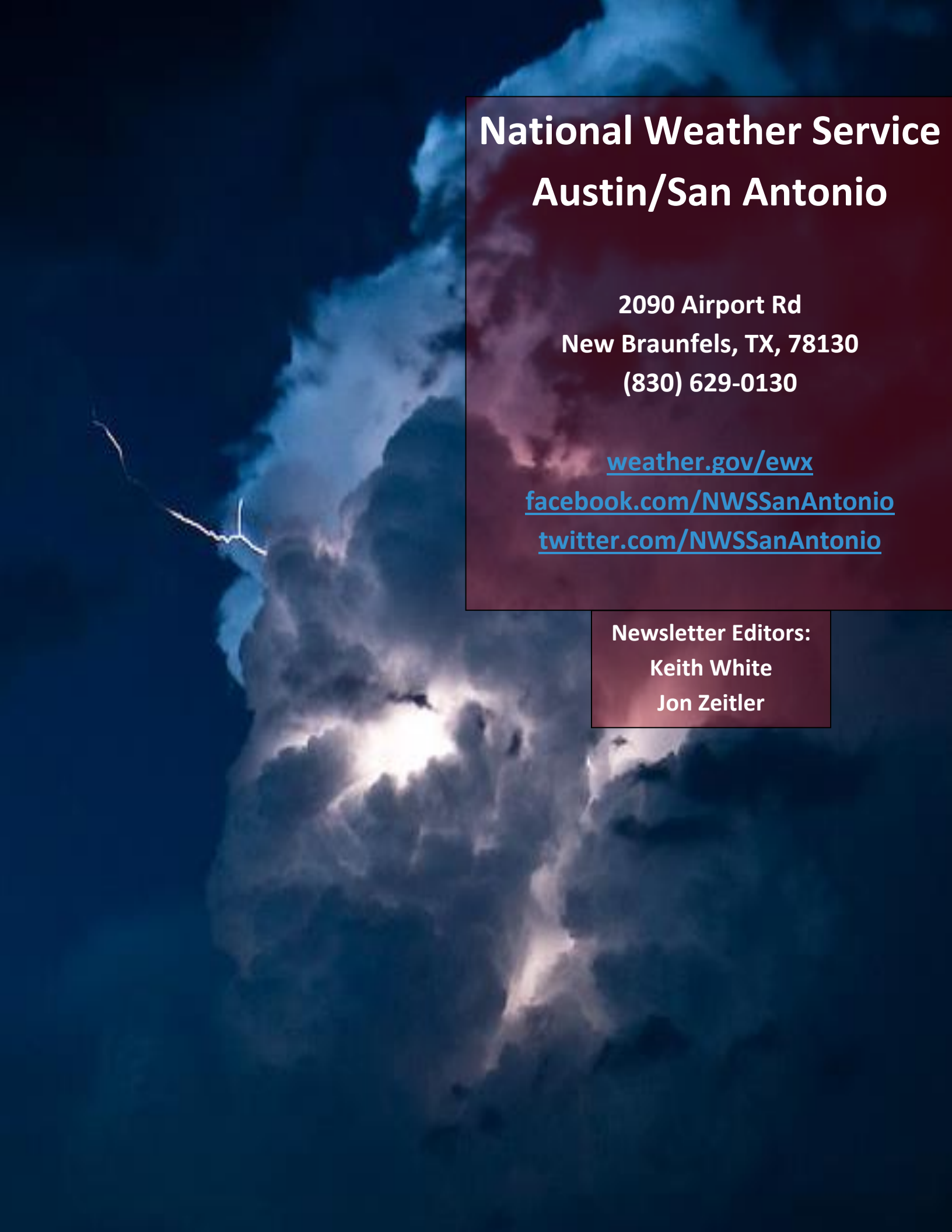
The Del Rio, TX AROS

Two balloon launches are scheduled each day, for 00 Universal Time Coordinated (UTC), which is 7 pm Central Daylight Time (CDT) or 6 pm Central Standard Time (CST) and 12 UTC (7 am CDT or 6 am CST), with the capability for additional flights when severe weather is expected or a tropical system is approaching the United States from the Gulf of Mexico. The entire AROS initiation, launch, and monitoring takes place remotely from our office in New Braunfels. The time window for regular flights is from 60 minutes prior to 29 minutes after, 00 or 12 UTC. In the event there is a problem with the flight preparation, or the flight terminates prematurely, AROS will automatically launch another flight, still getting the data within the time window.

AROS prepares each flight by checking the current ground weather conditions and communications. It then loads a radiosonde and fills the balloon, then waits for the automated launch time, or manual approval for launch from a meteorologist on duty. As the balloon rises, temperature, pressure, and humidity are recorded every second, and data transmitted periodically once certain levels in the atmosphere are reached. Winds are calculated by tracking the balloon via GPS and the lateral movement of the balloon itself during its ascent. The balloon must reach at least 400 mb to count as an official flight. If the balloon bursts or the radiosonde fails before reaching 400 mb, AROS will automatically initiate a second flight. Our meteorologists monitor all flights and data. One of the things they check is the balloon's ascension (rising) rate. The ascension rate can be adjusted for future flights by modifying how much hydrogen is used to inflate the balloon. At the conclusion of a flight, the data is stored locally and transmitted around the United States and to other countries.

This is an exciting new chapter in our ability to monitor the atmosphere! In addition to monitoring the flights by our meteorologist staff, our electronics technicians maintain the equipment and balloon, radiosonde, and hydrogen gas replacements at the site.

A Weather Balloon Loaded Inside the AROS



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