Book of Abstracts

Between-Eclipse Remote Conference (BERC)

Ames, IA

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Between-Eclipse Remote Conference (BERC)

Stratospheric Ballooning Association

Book of Abstracts

Editors

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Contents

BERC Schedule

Session start time (CST)	Session	Institution/Team	Title
9:00	Welcome/Announcements		
9:10	S1 (Standard talks session 1)		
	S1A	Plymouth State University, Plymouth, NH	Plymouth State University's Results from the 14 October 2023 Annular Eclipse
	S1B	Embry-Riddle Aeronautical University, Prescott, AZ	ERAU National Eclipse Project: Annular to Total Eclipse
	S1C	Saint Francis University, Loretto, PA	SFU in the Stratosphere: Experiences of a New Stratospheric Ballooning Team
	S1D	University of Wyoming, Laramie Wyoming	Space Cowboys Eclipse Outreach in Wyoming and Beyond
10:15	P1 (Poster session 1)		
	P1A	University of Bridgeport, Bridgeport, CT 06604	University of Bridgeport High Altitude Ballooning During the 2023 Annular Solar Eclipse
	P1B	Gordon Cooper Technolgy Center, Shawnee, OK	Radiosonde Whereabouts Relay
	P1C	South Dakota School of Mines and Technology, Rapid City, SD	Picking A Launch Site
	P1D	Casper College/Kelly Walsh HS/Natrona County HS, Casper, WY	Collaboration With Others, Outreach, And Funding
	P1E	Delgado Community College, New Orleans, LA	Outreach to Anna's Place NOLA. Community Impact through NASA ASTRO CAMP ®
10:55	L1 (Lightning talks session 1)		
	L1A	Virginia Polytechnic Institute and State University, Blacksburg, VA	Practice Makes Perfect-ish, Virginia Tech's Annular Eclipse Experience
	L1B	NearSpace Education, Upland, IN	Expanding Eclipse Research Accessibility to Blind & Visually Impaired Students
	L1C	St. Cloud State University, St. Cloud, MN	St. Cloud State Participation in NEBP
	L1D	Delgado Community College, New Orleans, LA	Launching in Cities: Everything that Can Go Wrong, Will
	L1E	Casper College/Kelly Walsh HS/Natrona County HS, Casper, WY	Annular Eclipse Reflections And Stories | What Went Wrong, What Went Right, Collaboration With Others, Where We Were At, And Results From The Eclipse
	L1F	U of MN - Twin Cities, Minneapolis, MN	Investigation of Position Accuracy of the NEO-M9N u-blox GPS as a Function of Polling Rate in Support of NEBP Stratospheric Balloon Flights
	L1G	Gordon Cooper Technology Center, Shawnee, OK	Balloon Quick fill Connector Project
11:35	S2 (Standard talks session 2)		
	S2A	Montana State University, Bozeman, MT	NEBP Iso-Switch Test Fixture
	S2B	Central Washington University, Ellensburg, WA	How does a solar eclipse affect the Earth's atmosphere?
	S2C	University of Idaho, Moscow, ID	Determination of Planetary boundary layer height
	S2D	Arizona State University, Tempe, AZ; University of Arizona, Tucson, AZ; Casa Grande Union High School, Casa Grande, AZ	Arizona Eclipse Ballooning Project
12:45	K (Keynote)		
	K1	Montana State University, Bozeman, MT	Nationwide Eclipse Ballooning Project: Where we've been and where we're going
13:25	S3 (Standard talks session 3)		
	S3A	University of Nebraska at Omaha	Nebraska NEBP Team 2023 Annular Solar Eclipse
	S3B	Casper College/Kelly Walsh HS/Natrona County HS, Casper, WY	Customization Via 3D Printing In The NEBP Engineering Track
	S3C	Salish Kootenai College, Pablo, Montana	Salish Kootenai College Ballooning Eclipse Team (SKC-BET) Ground Station Data Log
	S3D	University of North Florida, Jacksonville, FL 32224	High-Altitude Balloons Flights on an Annular Solar Eclipse
14:30	P2 (Poster session 2)		
	P2A	University of Bridgeport, Bridgeport, CT, 06604	High Altitude Robotic Monkey 2.0
	P2B	Fond du lac Tribal and Community College, Cloquet, MN	Radiosonde antenna position vs. GPS reception during radiosonde initialization
	P2C	U of MN - Twin Cities, Minneapolis, MN	Using a Pixy2 Robot Vision Camera for Sun-Tracking and Camera-Pointing on Stratospheric Balloon Flights
	P2D	Casper College/Kelly Walsh HS/Natrona County HS, Casper, WY	Soft Skills Involved With NEBP
	P2E	Montana State University, Bozeman, MT	Gravity Wave Analysis with GPS Data
15:10	L2 (Lightning talks session 2)		
	L2A	University of Nebraska-Lincoln, Lincoln, NE	Expectations Versus Reality: Overcoming High Altitude Balloon Obstacles During the Annular Solar Eclipse

	L2B	St. Catherine University, St. Paul, MN	Reflection from Socorro NM surrounding the Oct 14th 2023 Annular Eclipse
	L2C	U of MN - Twin Cities	Eclipse Video-Streaming with a Cell Phone and Eclipse Observing with a Sunspotter Telescope: Outreach Recommendations from the U of MN – Twin Cities NEBP Team
	L2D	St. Catherine University, St. Paul, MN	Effect of High Altitude Radiation On Brassica rapa Flown In The Stratosphere On Weather Balloons
	L2E	Salish Kootenai College, Pablo, MT	The Evolution of Field Campaign Roles & Responsibilities on a Tribal College High Altitude Ballooning Team
	L2F	Eastern Michigan University, Ypsilanti, MI	High Winds and Brittle Vents
	L2G	Penn State University, State College, PA	Mission Success through Collaboration
15:50	S4 (Standard talks session 4)		
	S4A	University of Maine, Orono, ME	Video Streaming with the Raspberry Pi 5
	S4B	U of MN - Twin Cities, Minneapolis, MN	Development of the HERMES Ground Station Pointing GUI for NEBP Eclipse Ballooning Teams
	S4C	South Dakota School of Mines and Technology, Rapid City, SD	The Sun is Dead' - Respecting Local Cultures
	S4D	Gordon Cooper Technology Center, Shawnee, OK	GPS Differential Radiosonde Tracker
16:50	Recap/Announcements		

Welcome

Welcome to the Between-Eclipse Remote Conference, also known as BERC. In partnership with the National Eclipse Ballooning Project (NEBP), the Stratospheric Ballooning Association is excited to present this remote conference. Teams from different parts of the United States participated in the groundbreaking event of launching high-altitude balloons before, during, and after the Annular Eclipse in October 2023. These same teams are gearing up to do it again for the total solar eclipse in April 2024. With this conference, teams can share their knowledge and learn from each other as they prepare for the upcoming eclipse.2023. Those same teams are preparing to do that again for the total solar eclipse in April of 2024. With this conference, teams can learn from each other as they prepare for the next eclipse. We hope that everyone enjoys the conference, and good luck in April!

Matthew E. Nelson
Stratospheric Ballooning Association President

Sponsors and Acknowledgements

Sponsors

We would like to thank the Stratospheric Ballooning Association for providing time and resources to run this conference. We would also like to thank the Minnesota Space Grant Consortium and especially Dr. James Flaten for setting up the Zoom for this conference.

Acknowledgements

We would like to give a big thank you to Dr. Angela Des Jardins and her crew with the National Eclipse Balloon Project. It is under Dr. Des Jardins and her leadership that has made these eclipse flights a huge success.

Abstracts

Plymouth State University's Results from the 14 October 2023 Annular Eclipse

Genevieve Picciano, Eric Kelsey

Plymouth State University, Plymouth, NH

The Nationwide Eclipse Ballooning Project (NEBP) is a NASA-funded project with the objective to engage students in a NASA mission-like adventure in data acquisition by studying the impacts of solar eclipses on the atmosphere during both the 2023 and 2024 solar eclipses. As a part of the project for the 2023 eclipse, 19 atmospheric science teams located along the path of annularity released radiosondes hourly starting 24 hours before annularity and ending six hours after. Hourly profiles of temperature, dewpoint, pressure, and wind speed and direction up to about 30,000 m asl were collected. We believe hourly radiosonde launches over 30 hours by 19 teams created the most spatiotemporally-dense dataset of radiosonde profiles ever collected. Additionally, each team had a surface weather station at their launch site collecting surface observations at 2-second intervals of temperature, dewpoint, relative humidity, pressure, wind speed and direction, and solar irradiance. To gather higher temporal resolution data, a super-site of five closely-sited teams was located in Moriarty and Belen, New Mexico. The hourly radiosonde launch times were staggered such that a radiosonde was launched every 12 minutes for the duration of the campaign.

This presentation focuses on a preliminary analysis of radiosonde and surface weather data collected by two Plymouth State University atmospheric science teams in Moriarty, NM during the 14 October 2023 annular solar eclipse with a focus on the planetary boundary layer response as a function of solar irradiance. Analyses include time series plots of surface measurements for the entire 30-hour campaign and skew-t diagrams.

Type of Presentation: Standard talk

Presentation Session/Order: S1A

Presentation Link: https://youtu.be/jyhOyxdcI4w

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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ERAU National Eclipse Project: Annular to Total Eclipse

Somaralyz Grullon, Mackenzie Shugart, Zach Howe ,Winona Roulston, Chloe Reed, Benjamin Knoelle, Kyle Laclair, Evan Hiland, Calvin Lindemann, Santiago Nuno, and Kevin Zamora

Embry-Riddle Aeronautical University, Prescott, AZ

The ERAU National Eclipse project involves testing and comparing the performance of two different radio frequencies, 900MHz and 2.4GHz, for satellite and UAV applications. There are 7 payloads part of this project that are attached to a high-altitude balloon, One payload will transmit live video via raspberry pi. Another payload will send telemetry data over a 900MHz link using an RFD900+ Modem. The signals will be received with high-gain antennas on a tracking ground station, and the on-board pterodactyl board will collect the same telemetry data for comparison purposes. The goal of the project is to characterize the quality and range of radio links to guide future university aerospace projects. The project will provide valuable information on the performance of different frequencies and equipment, helping to improve satellite and UAV technology in the future.

Type of Presentation: Standard talk

Presentation Session/Order: S1B

Presentation Link: https://youtu.be/f3EtFHQ9TR0

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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SFU in the Stratosphere: Experiences of a New Stratospheric Ballooning Team

Olivia Baldini, Nathan Cammarata, Hugh Flanagan, Stephen McGinnis, Abby Meehan, Kevin Salmon, Anna Belle Stover, Nicole Himes, Meagan Wheeler, Br. Marius Strom, Dr. Lanika Ruzhitskaya, and Dr. Rachel Wagner

Saint Francis University, Loretto, PA

The solar eclipses of October 2023 and April 2024 present a unique environment for scientific research, and, thanks to the Nationwide Eclipse Ballooning Project (NEBP), a unique opportunity for undergraduate students. Through the training and support provided by the NEBP in the Spring of 2023, Saint Francis University (SFU) has formed an engineering track team, SFU in the Stratosphere. This team began its ballooning experience with a six week launch campaign in Summer 2023, launching and recovering its first three weather balloons in a 14-day period during the month of June. The experience gained during this time was vital as the team gained new members in Fall 2023 and traveled to New Mexico to launch during the Annular Eclipse on October 14, 2023.

SFU in the Stratosphere has developed a small set of custom payloads, including a custom datalogger, tree-recovery assistant payload, Geiger counter for cosmic radiation measurement, and a thermoelectric generator. These payloads were developed, in part, in response to lessons learned during SFU's 5 inaugural launches, ideas for future research projects, and to meet the demands of the NEBP. While not all of these payloads will, necessarily, fly during the final launch of the NEBP, they will provide a foundation for the next generation of SiS team members.

SFU is presently preparing for launch during the total eclipse in April 2024 with a planned release point just north of Fort Worth, Indiana.

Type of Presentation: Standard talk

Presentation Session/Order: S1C

Presentation Link: https://youtu.be/ZiP8anoYhcw

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Space Cowboys Eclipse Outreach in Wyoming and Beyond

David Gordon, Amelia Myers, Phil Bergmaier, Lauren Kim

University of Wyoming, Laramie, WY

This presentation will focus on the various ways our NEBP team has done outreach before, during, after, and between the eclipse campaigns. We will highlight local outreach events in Wyoming that were completed before the October annular eclipse, outreach activities we did with classrooms in Richfield, Utah during the annular eclipse campaign, and our planned outreach for the future. This future outreach includes several local balloon launches this spring, the University of Wyoming's Undergraduate Research Day in April, and an outreach day at local schools near Bluffton, Ohio, where our team will be stationed for the total solar eclipse.

From the outreach events weÕve conducted so far, we have been given the opportunity to learn from our trials before and during the first eclipse. These challenges have taught us several innovative ways to engage an audience while talking about eclipses, atmospheric science, and technology. Using tools like 3D models, videos, and interactive exercises, we found that students stayed engaged in our presentations. During each event, we tailored our presentations to fit the skill level and understanding of the students we were visiting. This was done by structuring the presentation in a modular style, with the more difficult portions omitted for younger audiences. These methods will continue to be put to use in the future to ensure our planned outreach events are engaging and exciting to any audience.

Type of Presentation: Standard talk

Presentation Session/Order: S1D

Presentation Link: https://youtu.be/A1MrqWUhl3E

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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University of Bridgeport High Altitude Ballooning During the 2023 Annular Solar Eclipse

Huy Huong, Juan Urrea Vargas, Vamsi Sripada, Anass Saoudi, Sushma Gudi, Daria Howard, Roger Beadle, Dr. Jani Pallis, David Mestre, Larry Reed, Gary Moyher, Sam Zhang

University of Bridgeport, Bridgeport, CT

For the October 2023 annular solar eclipse, the University of Bridgeport Engineering High Altitude Ballooning team was composed of undergraduate and graduate students, their faculty advisor and experienced mentors. As members of the pod lead team for the East Central region, their mission was to assist and provide support for six other northeast university teams as well as develop payloads capable of enduring near-space conditions. The team's objectives included providing a proof of concept, executing a test flight under conditions similar to those expected during the Total Solar Eclipse of April 2024, and fostering undergraduate proficiency in practical engineering and design reflective of real-life challenges. Over several months, the team engaged in designing and constructing the payload boxes, as well as assembling integral components of the campaign, including the Ground Station, Pterodactyl, Venting System, tracking with the NAL Satellite System and iridium and Montana StateÕs Borealis system and Video Payload. This poster presentation shares the insights gained from the construction of high-altitude balloon payloads, the management of annular eclipse day operations in Junction, Texas, and the team challenges encountered such as launch and recovery logistics. Furthermore, it outlines proposed enhancements for the payloads in preparation for the 2024 Total Solar Eclipse.

Type of Presentation: Poster

Presentation Session/Order: P1

Presentation Link: https://youtu.be/utfp-v_oSRM

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Radiosonde Whereabouts Relay

Therron Kidd, Chance Stark, Robert Wood, Ron Markum, Aaron Bushong

Gordon Cooper Technolgy Center, Shawnee, OK

During the 2024 Total Solar Eclipse Gordon CooperÕs Nationwide Eclipse Ballooning Project team is traveling to Broken Bow, Oklahoma, where there are no permanent radiosonde stations to record the location of the teamÕs launched balloons. The goal of the Radiosonde Whereabouts Relay (RaWR) was to create a radiosonde station that is portable and is able to broadcast data from any location with access to cellular data. The RaWR teamÕs station relays data received from radiosondes to Sondehub.org, a popular website used to track radiosondes across the world, and is capable of doing so from great range. The RaWR system uses a single motherboard Raspberry Pi 4 in a ventilated wooden case powered by a 5 Amp rechargeable battery. The Raspberry Pi receives information from our antenna through an attached RTL-SDR, which turns captured radio waves into interpretable data packets. This data is sent to and processed by our decoding software, Auto RX. Auto RX also uploads the decoded data to the radiosonde tracking website SondeHub. In the future, RaWR plans to make the process autonomous, initializing the software as soon as the system is booted. The data RaWR receives is poorly organized at the time of writing, and is to be improved. This portable project is able to fill in the gaps on SondehubÕs grid, going where no station has gone before.

Type of Presentation: Poster

Presentation Session/Order: P1

Presentation Link: https://youtu.be/utfp-v_oSRM

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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Picking A Launch Site

Peggy Norris

South Dakota School of Mines and Technology, Rapid City, SD

Picking a launch site to meet the requirements of the National Eclipse Balloon Project (NEBP) can be tricky. Once the ground station site is fixed (giving high speed access to the internet for streaming, power and perhaps public outreach), then the launch site can be chosen so that the balloon passes within 10-20 miles of the ground station site at an optimal altitude for video. Historic weather data can be used to estimate potential balloon paths, but the final location cannot be fixed until within a day or two of the launch. Having someone on the ground several days ahead to scout locations is an important part of the process. Next, one has to have confidence that the balloon will land in an accessible area, with the added complication of potentially heavy traffic on eclipse day. If one is confident in the venting and cutdown unit, then there is some control of this, but in either case, it takes knowledge of the local area, something that the team may not have if they are traveling a distance for the eclipse. Having local partners who can be consulted during planning (and also be on hand during the eclipse) is extremely important in this regard. We will discuss our experiences on the ground in northern New Mexico in 2023 and the lessons learned for 2024, when we will be launching somewhere east of Dallas, with our ground station site in Sulphur Springs, TX.

Type of Presentation: Poster
Presentation Session/Order: P1
Presentation Link: https://youtu.be/utfp-v_oSRM
NEBP affiliation (if any): NEBP Engineering (videostreaming) team
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Collaboration With Others, Outreach, And Funding

Lily Trujillo, Ashlinn Stoneking, Lucus Cooper

Casper College/Kelly Walsh HS/Natrona County HS, Casper, WY

Throughout the NEBP journey, teams are strongly encouraged to engage with their communities to reveal the opportunities inherent in and beyond the NEBP program. Ultimately, Casper College's Wyoming Space Engineers (WySE) took a multifaceted approach. For example, students took active participation in the NEBP forum, particularly in the realm of optimizing live streaming video and learning about components relevant to the cutdown system such as light interpretation. Regardless, WySE's efforts did not go unnoticed as a plethora of local media outlets, such as Oil City News and K2 news, highlighted our team's pursuits. Additionally, a vital member of WySE played a significant role in showcasing the NEBP project on Wyoming News Now, highlighting the innovative aspects and goals of the project, shedding light on its importance to education and STEM. Outside that, engaging with neighboring teams found itself equally important. For instance, WySE often visited and aided in the launch of Riverton, WyomingÕs NEBP team which fostered a healthy relationship where they too would often visit and aid in our launches. Beyond that, WySE often sought guidance from the University of WyomingÕs Atmospheric Track via practice launches and retrieval missions, allowing us to solidify our commitment to community involvement and knowledge sharing between teams. Moreover, a few WySE members also attended a Wyoming Space Grant Consortium meeting to present their experiences and gratitude for the NEBP project and why funding projects such as these are immensely useful in allowing students to explore new avenues of work and science. In short, the integral support from the Wyoming Space Grant Consortium and Casper College's BOCES program has played a vital role in our outreach efforts, providing an excellent backbone for our engagement. Beyond simply ballooning, NEBP is a platform not just for personal growth but for cultivating the spirit of shared learning.

Type of Presentation: Poster

Presentation Session/Order: P1

Presentation Link: https://youtu.be/utfp-v_oSRM

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Outreach to AnnaÕs Place NOLA. Community Impact through NASA ASTRO CAMP

Josef Hightower, Cullen McKinley, Samuel Overton, Sheldon Scott, Joanna Rivers

Delgado Community College, New Orleans, LA

This presentation discusses our student outreach with our Eclipse Ambassador team at Anna's Place NOLA. Delgado Community College and Dillard University performed 3-5 hours of outreach weekly through fall semester at Anna's Place NOLA, a K-12 out of school program. Delgado is a NASA ASTRO CAMP Community Partner who has been working with AnnaÕs Place for three years. We will present how, through our partnership, Anna's Place NOLA was able to secure a TEAM II ANKR award. Some of this funding, with an addition from private donors, will enable 26 children, faculty and chaperones to join our atmospheric ballooning teams in Morrilton, AR for the eclipse. The students will be assisting with our teams' public outreach events prior to the beginning of launch. We will present our eclipse specific activities beginning with NASA's Eclipse Safety rules and learning how to use eclipse glasses correctly. We will outline successful and less successful activities for engaging our K-12 audience.Delgado and Dillard's education partnership with K-12 students assisted Delgado and Dillard's teams in San Antonio through public awareness. We had the students design our safety posters, attracting many families to our launch site. We will briefly outline our curriculum plans for the spring semester in preparation for the total eclipse. This partnership between informal education teachers, K-12 students, university students, and NASA demonstrates a working model of commitment to our community and leveraging support from external sources to scaffold educational partnerships.

Type of Presentation: Poster

Presentation Session/Order: P1

Presentation Link: https://youtu.be/utfp-v_oSRM

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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Practice Makes Perfect-ish, Virginia Tech's Annular Eclipse Experience

Kevin T. Sterne, Virginia G. Smith, Erika L. Ashley, Corie M. Bryant, Abigail M. DeCosta, Jivitesh Kukreja, Brenden Lech, Brian R. Van Dyke, Tejas Vinod

Virginia Polytechnic Institute and State University, Blacksburg, VA

Virginia Tech's high-altitude ballooning team is relatively new with much of the team forming with being selected as one of the Nationwide Eclipse Ballooning Project's (NEBP) engineering track teams.Ê The team began practicing high-altitude balloon flights in April 2023 with a goal of launching NEBP payloads on one flight string in addition to Virginia Tech student built payloads on a second flight string for the October 2023 annular eclipse.Ê One of the biggest challenges with a high-altitude balloon flight during an eclipse is having a relatively small launch window which will achieve the goal of having the balloon at target altitude range during the few minutes of totality.Ê Along with this challenge of a flight during the eclipse, the Virginia Tech team faced challenges of handling two balloon launches within the launch window with a reduced personnel size due to the distance of the launch site from the home institution.Ê The team also faced a number of last minute hardware issues which impacted the launch day timeline from concurrent filling to sequential filling of balloons.Ê For this conference, we present an overview of the team's experience of launching high-altitude balloons during the October 2023 annular eclipse outside of Roswell, NM, and how creating and practicing a launch timeline made a difference for our team.Ê In addition, we present Virginia Tech's two flight strings, their payloads, their flight tracks and the overall results for each of the flight strings.Ê Lastly, we present a few of our lessons learned in preparation for the April 2024 total solar eclipse.

Type of Presentation: Lightning talk

Presentation Session/Order: L1A

Presentation Link: https://youtu.be/jD9H3xuCGuo

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Expanding Eclipse Research Accessibility to Blind & Visually Impaired Students

Brandon Pearson

NearSpace Education, Upland, IN

According to the CDC, Blind and visually impaired (B/VI) students make up approximately 3% of the total student population of the US. These students cannot participate in and benefit from many STEM experiences, including the total solar Eclipse passing through Indiana in 2024. However, recent technological innovations have begun to remove this barrier. In Spring 2023, NearSpace Education (NSE) partnered with Tactile Engineering, Inc., an Indiana tech startup, to increase the accessibility of the Eclipse to B/VI individuals. Tactile Engineering manufactures a device that allows B/VI students to view graphics, monitor data from experiments, and even experience live video of the eclipse in the same way sighted audiences do. NSE used these devices to display the atmospheric data collected by a high-altitude balloon in real time for the students to experience. Trials of this dual system with the students from the Indiana School for the Blind and Visually Impaired took place in October 2023 with great success, and plans are in place to expand the capabilities of this learning experience for the Total Solar Eclipse in April. During this presentation, we will share about this technology breakthrough, our experience with B/VI students as we prepared them for the October annular eclipse, the results from the October test, and our plans to increase the number of B/VI individuals that can "physically" experience the eclipse in ways that were previously not possible.

Type of Presentation: Lightning talk

Presentation Session/Order: L1B

Presentation Link: https://youtu.be/FSn8LwWaUTg

NEBP affiliation (if any): SBA Member who is also doing balloons during the 2024 Eclipse.

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St. Cloud State Participation in NEBP

Rachel Humphrey, Caity Andersh, Amanda Banyas, Azara Boschee, Regina Fleischman, Annette Lujan, Sophie Tice

St. Cloud State University, St. Cloud, MN

In 2022, a faculty member from St. Cloud State University (SCSU) was invited to participate in a national project specifically geared toward stratospheric ballooning. Supported by a team of six undergraduate students with academic backgrounds in atmospheric science and science education, the Nationwide Eclipse Ballooning Project (NEBP) provided numerous learning opportunities for all involved. From introduction to the project to launching balloons for 30 straight hours in October 2023, this presentation will focus on the experiences of faculty and students from SCSU in the context of this "new to us" project.

Topics to be discussed will include events and processes relating to discovery of the project; finding regional academic partnerships; student recruitment (and retention!); training up on the equipment via workshops; perceived benefits of the cohort method associated with training faculty and students; teaching and learning the ins and outs of stratospheric ballooning; obtaining financial support for student participants; preparing for field deployment; life in the fieldwork phase; challenges encountered; and lessons learned throughout. Perspectives from both the faculty member and students will be presented and sample data will be shared. Additional space and time will be dedicated to how lessons learned during the 2023 eclipse phase will inform routines and practices during the 2024 eclipse.

Type of Presentation: Lightning talk

Presentation Session/Order: L1C

Presentation Link: (https://youtu.be/FYaQ7MDc4DY)

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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Launching in Cities: Everything that Can Go Wrong, Will

Josef Hightower, Cullen McKinley, Darian Moses, Marcello Munguia, Samuel Overton, Ashley Pailet, Sheldon Scott, Joanna Rivers

Delgado Community College, New Orleans, LA

This presentation walks through a detailed breakdown of Dillard University and Delgado Community College's Atmospheric teams' preparation for the Annular Eclipse in 2023. Our selected destination was San Antonio, TX, in the cityÕs airspace. In order to prepare our team, our practice launches were held in New Orleans under the New Orleans International Airport's airspace. We had extensive conversations with our local Air Traffic Controller which led us to begin communication with San Antonio Air Traffic Control a month prior to our launch date.Our presentation will discuss what we learned about the challenges launching high-altitude balloons in high traffic areas. We present a timeline to notify local and regional airports, who to contact to submit a HIBAL (High Altitude Ballooning) worksheet form and flight prediction maps. We walk through updates that may be requested by airports and cover what went wrong.Our lessons learned include several potential disasters, the worst of which was being shut down by San Antonio Air Traffic Control. Other challenges included notifying a nearby Air Force Base, finding a new launch location overnight, adverse weather, communication challenges, the tight timeline to contact each airport at launch, landing, and 30,000 feet.The team presents what it learned about planning for alternate launch sites in advance, creating checklists, writing a script to communicate with Air traffic control, a list of what to include in any communication with airports, the importance of setting countdown timers, converting your latitude and longitude to a fixed radial distance before filing a NOTAM, ensuring you have the proper city and neighborhood permits, contacting local police and sheriff's departments, printing and keeping all communication in a readily available, visible, and labeled binder.

Type of Presentation: Lightning talk

Presentation Session/Order: L1D

Presentation Link: https://youtu.be/FLSja9ghObE

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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Annular Eclipse Reflections And Stories | What Went Wrong, What Went Right, Collaboration With Others, Where We Were At, And Results From The Eclipse

Lily Trujillo, Ashlinn Stoneking, Lucus Cooper

Casper College/Kelly Walsh HS/Natrona County HS, Casper, WY

The Annular Eclipse occurred in Fall on October 14, 2023, and The Nationwide Eclipse Ballooning Project and individuals alike flocked all across the western half of the United States to catch a glimpse of the eclipse along the path of annularity. NEBP teams were scattered, ranging from NASA in Albuquerque to Casper College in Richfield, Utah. In Richfield, one of the best cities for viewing, the eclipse coincided with a fall festival alongside a STEM outreach event for kids and families to come learn more about STEM. There, Casper College set up base to begin launching ballooning, followed by colleges and universities from Chicago, IL; Central Wyoming College in Riverton, WY; and the University of Wyoming in Laramie. The event enabled Casper College NEBP students to showcase the project to eager, curious children and a chance to collaborate with adjacent teams and see what they changed within the project. Overall, the experience provided a valuable opportunity to compare and contrast with the work of the Wyoming Space Engineers (WySE) in Casper, WY. Regardless, a plethora of trials and tribulations happened and it appeared to have been a universal struggle with live streaming data to lost parachutes and balloons. EveryoneÕs experience was different but we hope to learn and improve from our first eclipse and gear up for the total eclipse in April.

Type of Presentation: Lightning talk

Presentation Session/Order: L1E

Presentation Link: https://youtu.be/yRbSbQGhYYI

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Investigation of Position Accuracy of the NEO-M9N u-blox GPS as a Function of Polling Rate in Support of NEBP Stratospheric Balloon Flights

Ashton Posey

U of MN - Twin Cities, Minneapolis, MN

The Nationwide Eclipse Balloon Project (NEBP) is using weather balloon flights to study atmospheric phenomena in the troposphere and stratosphere, and the effects of solar eclipses on such phenomena. One phenomenon being studied is atmospheric gravity waves. In the study of gravity waves from balloon-borne platforms, a high accuracy and high update frequency GPS is required. Both the NEBPÕs RFD900 and PTERODACTYL data loggers use the NEO-M9N u-blox GPS (hereafter just called the M9N). The M9N has a maximum polling rate of 25 Hz and an advertised 1.5 meters of horizontal accuracy. This presentation will describe observed effects on accuracy for various polling rates of the M9N. When polled slower than 10 Hz, the M9N can communicate with a maximum of 32 satellites at any one time. This means that at 9.9 Hz the M9N will be able to see 32 satellites, but at 10 Hz the M9N will drop to a maximum of 16 satellites. This suggests that the M9N might have a better accuracy at a lower sampling rate, since more GPS satellites are able to be taken into account. However, ground testing has shown that this is not the case Ð the M9N has better accuracy when polled at 20 Hz than when polled at 8 Hz. It also has a much faster resolution speed, reaches high-accuracy more quickly upon start-up, and has better steady state accuracy. The reason for this might simply be that the M9N can get all it needs for position accuracy from only 16 satellites and that it derives essentially no benefit (or at least not in position accuracy) from communicating with up to 32 satellites.

Type of Presentation: Lightning talk

Presentation Session/Order: L1F

Presentation Link: https://youtu.be/lRqyHszLanc

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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The Balloon Quick Fill Connector (BQFC)

Benjamin Martin, Alden Bingham, Harley Halford, Elizabeth Mashek

Gordon Cooper Technology Center, Shawnee, OK

Preparing and launching weather balloons can be a time-consuming process, taking up to twenty minutes and multiple personnel. The Nationwide Eclipse Ballooning Project (NEBP) requires a balloon launch every hour for thirty hours, this necessitates an efficient process. The Balloon Quick Fill Connector (BQFC) identified two areas for improvement: attaching the balloon to the fill nozzle, and accurately filling the balloon to achieve a 5m/s ascent rate. The BQFC team created a clamping system that enables one person to attach the balloon to the helium fill nozzle in about 15 seconds. This clamping system was able to withstand the upward forces of the balloon while maintaining a secure connection between the fill nozzle and balloon, without helium leakage. The team incorporated the fill nozzle into a floating tripod mount that enables the user to reliably fill to the minimum buoyancy needed for a 5m/s accent. The tripod system has been designed to slide vertically upward with the force generated by the balloon. When the desired buoyancy is achieved, the tripod system rises to its upper vertical limit, indicating the balloon is ready to be launched. With these two innovations, BQFC has reduced the time it takes to fill and launch a balloon to less than two minutes and greatly increased the consistency of our balloon's ascent rate. This system was used during the October 2023 annular eclipse. The BQFC team intends to utilize this system for the April 2024 total eclipse.

Type of Presentation: Lightning talk

Presentation Session/Order: L1G

Presentation Link: https://youtu.be/u3qhLD9ZKJs

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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NEBP Iso-Switch Test Fixture

Randy Larimer, Maximus Marceau, Kris Allick

Montana State University, Bozeman, MT

A simple hardware test fixture has been provided to all the NEBP Engineering teams for evaluation of their tracking and control payloads. This talk will go over the use of this test fixture to build team confidence in understanding the subtle details that make the system function.
The NEBP Iso-Switch board is used for testing Iridium, OCCAMS, Vent and Cutdown boards as a system on the bench as well as through Iridium email commands. XBEE radio modules are used to communicate commands and status between the various payloads. The Iso-Switch board plugs in between the OCCAMS board and the Iridium tracking modem providing a visual indication of input and output pin states. An Iridium or Switches switch allows users to select the email control or switch control of the system. The emails can be sent and a visual indicator will show the current state of the system. The Iridium modem will need to be outside and have a clear view of the sky in this mode. Switches can be set to simulate the three pin commands used to control various payload functions. This testing can be done inside on the bench.
This easy to use test fixture allows teams of the NEBP to broaden their understanding of the tracking and control payloads as well as test out their complete systems before flights.

Type of Presentation: Standard talk
Presentation Session/Order: S2A
Presentation Link: https://youtu.be/CJV8rKtwftg
NEBP affiliation (if any): NEBP Engineering (videostreaming) team
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How does a solar eclipse affect the Earth's atmosphere?

Eli Pugsley, Elizabeth Tanner, Anandan Lakshminarayanan, Kayl Allen, Micheal Allen, Sean Benson, Hayden Burger, Joseph Gabrel Burke, Tristan Evans, Alexander Hardiman, Riley Mcginnis, Matt Ryan, Alison Prekeges, and Dr. Darci Snowden

Central Washington University, Ellensburg, WA

This project aims to collaborate with the Nationwide Eclipse Ballooning Project (NEBP) to deploy sensors up to 110,000 feet into the Earth's atmosphere via weather balloons before, during, and after a solar eclipse. The data collected will be analyzed to determine the height of the planetary boundary layer, and the presence of gravity waves following the eclipse. During the annular eclipse on October 14, 2023, our team from Central Washington University traveled to Chiloquin, Oregon. Beginning at 16:14 UTC, balloons with atmospheric sensors were launched every hour until 6 hours after the eclipse. In addition to the data collected by the radiosondes, ground conditions were recorded by a stationary sensor near the launch site. Visual observations before and after the eclipse were made as well. Because it rained most of the night preceding the eclipse, the data collected during that period will make it difficult to discern effects of the eclipse in the troposphere. Cloud cover may have also prevented the boundary layer from being strongly affected by the eclipse. Following totality, waves in the clouds were visually observed, but it is unclear if this resulted from the eclipse. There are several instances in the airborne sensor data where it appears the sensor briefly connected to a different receiver than its own, resulting in large jumps in position and atmospheric conditions. These instances must be removed from the data. Once cleaned, the data will be fed into a set of algorithms and computer programs to estimate the height of the planetary boundary layer before, during, and after the annular eclipse. Next, we will look for evidence of atmospheric gravity waves as a result of the eclipse.

Type of Presentation: Standard talk

Presentation Session/Order: S2B

Presentation Link: https://youtu.be/P7pRAqmvuVM

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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Determination of Planetary boundary layer height

Konstantine Geranios, Niraula Shashwot, Caeley Hodges, Logan Kearney, Ashley Keeley, Kyren Mesenbrink, Long Cole, Chase Cole, William Schaal, Dr. Matthew Bernards

University of Idaho, Moscow, ID

An Annular eclipse passed over North America on October 14th, 2023. A team from the University of Idaho launched Graw radiosondes on the hour from Lakeview Oregon, starting on October 13th at 15:00 UTC ending on October 14th at 22:00 UTC. The flight profiles were analyzed using three different analytical methods for determining the planetary boundary layer height. The potential temperature gradient method for determining the planetary boundary layer height is examined by identifying its maximum value with this indicating the planetary boundary layer height. The Virtual potential temperature methods identifies large deviations from its ground value and determines this to be the planetary boundary height. The Bulk Richardson method uses stability calculations to determine when a critical threshold is met and this is where this method determines the planetary boundary layer height to be. From these three analytical methods, that vary in their determination of the planetary boundary layer height, atmospheric conditions of saturation, stability, and whether a nocturnal boundary layer is present were analyzed to determine which method was to be chosen for each flight. During the annular solar eclipse the planetary boundary layer stayed consistent which on a day without an annular eclipse one would expect to see a large increase in the planetary boundary height. These findings are consistent with the expected outcomes.

Type of Presentation: Standard talk

Presentation Session/Order: S2C

Presentation Link: https://youtu.be/C3ryOqfFfbE

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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Arizona Eclipse Ballooning Project

Jacqueline Do, Megan Miller, Courtney Banks, Tyler Derrick, Everett Moore, Imaan Ahmed, Emily Ottesen, Ricardo Ontiveros, Muhammed Topiwala, Cristo Lopez, Dr. Thomas Sharp, Sarina Blanchard, Colin Brown, Andrew Kwolek, Razak Adamu, Vai Pujary, Dr. Steve Kortenkamp, Michelle Coe, Landri Howard, Emily Geen, John Morris

Arizona State University, Tempe, AZ; University of Arizona, Tucson, AZ; Casa Grande Union High School, Casa Grande, AZ

Arizona State University (ASU), the University of Arizona (UA), and Casa Grande Union High School (CGUHS) worked collaboratively on the development and deployment of a high-altitude balloon with the goals to (a) improve launch logistics, (b) optimize video streaming capabilities, (c) design, test, and implement 3D-printed payload housings, and (d) engage a large audience through social media and outreach efforts.

We opted for the unmanned free balloon without the implementation of the cutoff mechanism. During our launch in Roswell, New Mexico for the Annular Solar Eclipse, we aimed to achieve an ascent rate of 5-6 m/s and a total flight duration of about 1 hour and 30 minutes achieving burst at between 85,000-90,000 feet. Despite numerous successful practice launches, we instead reached an average ascent rate of just 1-2 m/s with a flight duration of 3 hours and 45 minutes, still bursting at about 89,000 feet (about 27,000 meters). We have determined the cause of this complication to be the result of a miscalculation of the lift weight. Arizona Near Space Research (ANSR) acted as our recovery team and traveled to the new predicted landing site during the flight, recovering the payloads over 80 miles from the border of New Mexico/Texas to northeast of Lubbock, Texas, far surpassing the intended landing location. Though the flight parameters did not align with our expectations, we were successful in nearly every other aspect of the launch thanks to our practice as mentioned in earlier launches.

We 3D-printed the housings for all payload systems, except the Raspberry Pi camera system. ASU developed the Iridium housing using Thermoplastic Polyurethane (TPU) and Polyethylene terephthalate glycol (PET-G) filaments to withstand potential high-velocity crashes. UA developed the RFD900 and PTERODACTYL housings using PET-G filament and Polyethylene foam (pool noodles). Due to weight and time constraints, we used Extruded Polystyrene (XPS) for the Raspberry Pi camera system housing. It was observed upon retrieval that each system

housing survived the impact. Though being highly durable and offering adequate protection, the 3D-printed housings present two drawbacks: (1) extended printing time and (2) increased material weight.

ASUÕs ground station team optimized the network stability and performance of the Ubiquiti long-range radio system by diagnosing and troubleshooting network parameters during extensive testing, making use of a Ubiquiti WiFiMan Wizard. Minor network disruption was encountered periodically before a complete loss of connectivity at an altitude of 22,500 feet and a total distance from the ground station of 28.5 miles, approximately 1 hour into the flight. This was a significant improvement from what we encountered during previous practice flights.

In analyzing the dataset gathered during the flight, key data points were selected to illustrate changes in atmospheric conditions. At Point A, 15 minutes before the start of annularity, the temperature and pressure were 35.26 (1.81) and 0.21ATM. At Point B, at the moment of annularity, the temperature and pressure were 26.47 (-3.07) and 0.15ATM. At Point C, 15 minutes after the start of annularity, the temperature and pressure were 21.7 (-5.72) and 0.1ATM. The change in temperature between Point A and Point B shows a temperature difference of 8.79. Between Points B and C, the change was 4.77.

In addition to our science goals, our team focused on social media and outreach initiatives, aiming to connect with a diverse audience ranging from high schools and universities to the general public. We showcased our project to students and attendees from various institutions, including Eastern New Mexico University (Roswell), ASU Prep College and Career Fair, ASU Space Business Association, ASU Astronomy Club, Joliet Township High School, and Casa Grande Union High School. The culmination of our efforts was a successful Annular Solar Eclipse viewing party and launch live-streaming event on ASUÕs Tempe Campus, hosted in partnership with the School of Earth and Space Exploration (SESE) outreach team. There were over 400 people physically in attendance. We garnered over 200 viewers on the YouTube livestream. On social media, we have over 142 followers and have reached more than 1,547 accounts, having accumulated over 10,000 impressions.

Type of Presentation: Standard talk

Presentation Session/Order: S2D

Presentation Link: https://youtu.be/FNM_QOp0RMA

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Nationwide Eclipse Ballooning Project: Where we've been and where we're going

Angela Des Jardins, Randy Larimer, Marissa Saad

Montana State University, Bozeman, MT

It's hard to believe that the 53 Nationwide Eclipse Ballooning Project (NEBP) teams have been fully participating for a year now and that the total eclipse is less than three months away! In this talk, we'll look back at what NEBP has already accomplished, such as flying 600 balloons for the annular eclipse, collecting 5TB+ of data, and engaging over 800 students and mentors. WeÕll also preview plans for the big day, including being seen by the 1 billion people (yes, billion) NASA expects on their live broadcast. NEBP is a unique project that is both an education effort and cutting-edge research Ð letÕs celebrate what the project means to us as individuals, as teams, to our communities, and also as inspiration for those who learn about it.

Type of Presentation: Keynote
Presentation Session/Order: K
Presentation Link: https://youtu.be/aKkZi3y_Ub8
NEBP affiliation (if any): Both
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Nebraska NEBP Team 2023 Annular Solar Eclipse

Derrick A. Nero, Ed.D., Kendra Sibbernsen, Ph.D., Karen Stelling, P.E.

University of Nebraska at Omaha

This presentation will highlight the preparation, execution, and findings of the October 2023 annular solar eclipse by the Nebraska NEBP (Nationwide Eclipse Ballooning Project) team. Nebraska NEBP is comprised of students and faculty from Metropolitan Community College (MCC), University of Nebraska - Lincoln (UNL), and the University of Nebraska at Omaha (UNO). An online course was designed and conducted by MCC for all student participants (pre-college and college). UNL hosted and conducted HAB and NEBP training and practice launches UNO provided HAB launch and recovery support.

The Nebraska NEBP team traveled to Roswell, NM for the October 2023 annular solar eclipse. Its launch team coordinated its launch from Hondo High School in Hondo, NM (47 miles west of Roswell, NM). Its ground station team coordinated with and tracked the HAB from Roswell, NM at University High School. All major HAB systems functioned to acceptable parameters including the PTERODACTYL, Iridium, RFD900, 360 camera system, video streaming, and the venting system.

The chase team tracked the HAB for 138 miles (maximum altitude: 81,138 feet) and recovered the payload near Pep, NM (near the New Mexico/Texas border). Several experiences and findings will be presented and dictate preparation and improvements to the Nebraska NEBP total solar eclipse HAB in April 2024.

Type of Presentation: Standard talk

Presentation Session/Order: S3A

Presentation Link: https://youtu.be/uArzk4o2tFg

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Customization Via 3D Printing In The NEBP Engineering Track

Lily Trujillo, Ashlinn Stoneking, Lucus Cooper

Casper College/Kelly Walsh HS/Natrona County HS, Casper, WY

The Engineering Track of NEBP focuses on live video streaming and imagery collection from the perspective of the balloon. Each team within this track employs different means by which this is accomplished, such as the utilization of 360 cameras, still cameras, and custom 3D printed parts. Part of the challenge involved in the Engineering Track is searching for solutions to problems as they abruptly appear. Some of the possible solutions that Casper CollegeÕs Wyoming Space Engineers (WySE) have developed with 3D printing include the PTERODACTYL v3.6, venting system, the 360 camera mount, and payload power switches. For instance, the PTERODACTYL collects important data throughout the flight and acts as a flight computer, so to prevent any damages during the payloads' descent, a case was designed and printed to protect the PTERODACTYL without compromising sensor sensitivity. Also, the venting system was provided through MSU but to fix a few issues with the open-and-close motion, a plan was devised to utilize a combination of string and miniature 3D printed parts to ensure smooth motion and reliability. Even today, a plan is being developed to redesign the entirety of the vent as to reduce the bulkiness of the original design and create a slimmer form using 3D printing. Moreover, the 360 camera collects clear views of the stratosphere that capture the entire breadth of the area. In yet another instance of 3D printing, a mount was modeled that fit the camera perfectly and held it at a height which allowed the cameraÕs range to not be inhibited by nearby payloads. Once printed, it provided a secure way to collect better imagery. Overall, this project would not be possible without the people involved who were experienced with 3D modeling and printing, and this process continues to further enhance the engineering process.

Type of Presentation: Standard talk

Presentation Session/Order: S3B

Presentation Link: https://youtu.be/hzAbciYClPg

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Salish Kootenai College Ballooning Eclipse Team (SKC-BET) Ground Station Data Log

Geo Maughan and Drew Grennell

Salish Kootenai College, Pablo, MT

This presentation shows and describes SKC-BETÕs Ground Station Data Log. The forms' evolution will be discussed. SKC-BET plans to use this form during the total eclipse in April 2024. Participating in the Nationwide Eclipse Ballooning Project (NEBP), SKC-BET launched weather balloons carrying atmospheric monitoring equipment every hour for 31 sequential hours during the October 14, 2023 Annular Solar Eclipse. This campaign was held at the National Weather Station in Elko, Nevada. Ground station communication with balloon payloads is central to both in-flight data collection and pre-flight initialization of the system. Collection of in-flight data depends on correct and complete initialization of the payload.

Initially we were given the Radiosonde Sounding Overview Form (RSOF) for the collection of data specific to each launch. Primarily the RSOF moves with the Weather Station tech from station to station as the launch progresses and retires to the collective folder upon completion of that specific launch. To facilitate a central data repository we developed a form to be filled out and reside at the Ground Station for the duration of the campaign. Current weather conditions from the weather station are used at the ground station to calculate balloon fill data as well as to initialize the radiosonde prior to launch. This data is gathered by the weather station tech and is also recorded by the ground station tech as part of the Ground Station Data Log (GSDL).

We developed this new form to fill a need at the ground station for data ready-at-hand as needed and as a collective history of the campaign. Its evolution over 31 launches at the October, 2023, Elko, NV Annular Eclipse will be discussed. It is our intent to use this modified and updated form in addition to the RSOF at the April 2024 Junction, TX Total Solar Eclipse.

Type of Presentation: Standard talk

Presentation Session/Order: S3C

Presentation Link: https://youtu.be/DtK6zK1ij0s

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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High-Altitude Balloons Flights on an Annular Solar Eclipse

Nirmalkumar Patel, Dustin Leonard, Collin Ott, Cory Pare, Lovely Ramos, Aryan Patel, Calla Taylor, Julian Rowe, and Larry Ratcliff

University of North Florida, Jacksonville, FL

Students from the University of North Florida (UNF) participated in NASAÕs Nationwide Eclipse Ballooning Program (NEBP). The UNF team visited Pearsall, Texas during October 12-15, 2023. A high-altitude balloon, Osprey, was successfully launched, and after 10 min, another balloon, Disney, was launched before beginning an annular solar eclipse from Pearsall, TX, USA. The main aims of the flights were to evaluate the performance of the vent and cutdown system, connectivity with a satellite iridium modem, RFD900, Raspberry Pi camera, 360-degree Insta camera, antenna, ground station, spot tracking, and ozone sensor payload.

The variation in the altitude of the Osprey and Disney balloons with flight time was measured. Osprey balloon reached the highest altitude at about 29886 m, while Disney balloon reached the highest altitude at about 32503 m. The maximum speed over ground for Osprey was 145.4 km/h while for Disney was 159.9 km/h. Both flights covered the entire annular eclipse. Our 3-D printed vent system worked well without helium gas leakage. We found that the Iridium satellite remained busy and kept us in queue to execute the cutdown command, and hence underwent a burst. We will discuss the failure of the iridium-related vent system. The variations in the temperatures inside and outside the payload with time were measured. The ozone concentration was measured using nanocrystalline composite oxide semiconductor thin films. Eight sensors were used to monitor the ozone concentration. The concentration of ozone in the stratosphere decreased throughout the annular solar eclipse. This may be because the amount of available UV light from sunlight decreased; hence, ozone formation also decreased. The variation in the UV light during the flight supported the results of the ozone sensors.

Type of Presentation: Standard talk

Presentation Session/Order: S3D

Presentation Link: https://youtu.be/vatxaX0XJWg

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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High Altitude Robotic Monkey 2.0

Huy Huong, Juan Urrea Vargas, Vamsi Sripada, Anass Saoudi, Sushma Gudi, Daria Howard, Roger Beadle, Dr. Jani Pallis, David Mestre, Larry Reed, Gary Moyher, Sam Zhang

University of Bridgeport, Bridgeport, CT

In 2018, through a NASA Undergraduate Student Instrument Project (USIP) grant, students from three Connecticut universities - University of Bridgeport, University of Hartford, and Wesleyan University - collaborated to develop a small robot designed for operation in near space conditions, deployed via a High-Altitude Balloon (HAB). Dubbed HAM (High Altitude Monkey), in homage to Ham the Chimpanzee, who flew into space prior to Astronaut Alan Shepard's historic 1961 Freedom 7 Mercury mission, the robot ascended to nearly 11,000 feet. During its flight, HAMÕs balloon capsule, collected environmental data, recorded video and live-streamed its interactions back to a local science museum, at a "mission control." For the upcoming 2024 Total Solar Eclipse, the high-altitude ballooning team from the University of Bridgeport intends to launch an advanced version of HAM in Junction, Texas, as a component of their outreach efforts for this Eclipse campaign. The refined model will feature enhancements in capsule design, robotics, and sensor programming to collect and relay telemetry data and interact with middle school students who will participate in "mission control" on the ground. Beyond the technical advancements, a crucial aspect of this initiative is the cultivation of undergraduate student skills in project management and leadership, aiming to foster a well-rounded educational experience.

Type of Presentation: Poster

Presentation Session/Order: P2

Presentation Link: https://youtu.be/Q9Gfh9QoXgY

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Radiosonde antenna position vs. GPS reception during radiosonde initialization

Steve Highland, Aurora Salzer, Danielle Pemberton, Cheri Caribou

Fond du lac Tribal and Community College, Cloquet, MN

We compare the numbers of GPS satellites our radiosondes were receiving during radiosonde initialization and early flight for our thirty balloon flights at the October 2023 annular eclipse in Socorro, New Mexico. ÊSince our NEBP Atmospheric Science team comprised students from Fond du Lac Tribal and Community College, St. Cloud State University and St. Catherine University, we used three separate receiver setups in slightly different locations. ÊWe wish to see if there is any correlation between our sonde initialization positions and the number of GPS satellites received and whether it might relate to challenges that were encountered in radiosonde initialization. ÊIf so, it may point to a need to move our radiosondes higher or farther away from buildings during initialization for the April total eclipse.

Early work on a few flights shows a slight dependence – rerunning Grawmet simulations from recorded flight .gsf data files shows the number of GPS satellites varying from 7 to 12 before launch to 12 satellites just after launch. ÊWe will compile comparisons for all 30 flights and initialization setups and search for any patterns.

Type of Presentation: Poster

Presentation Session/Order: P2

Presentation Link: https://youtu.be/Q9Gfh9QoXgY

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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Using a Pixy2 Robot Vision Camera for Sun-Tracking and Camera-Pointing on Stratospheric Balloon Flights

Yoel Mekbeb, Isaac Sheard, James Flaten

U of MN - Twin Cities, Minneapolis, MN

The U of MN Ð Twin Cities ballooning team is developing a payload that uses a Pixy2 robot vision camera to track the sun and point camera(s) either at the sun, or in specific direction with respect to the sun, during stratospheric balloon flights Ð especially eclipse balloon flights. The Pixy2 camera is able to identify and track objects, such as the sun, based on their color/hue. The goal of this payload is to use a Pixy2 to track the sun and point GoPro and/or Raspberry cameras during balloon flights. The Pixy2 cannot record videos directly Ð hence the need for it to help point other camera(s). The Pixy2 can be used to control servos, stepper motors, and/or linear actuators to keep a specific object (the sun) in the center of its view. During a total solar eclipse, the sun goes from being exceedingly bright to a dim object in the sky (just the corona). We will conduct ground tests to test algorithms, possibly involving adjusting brightness levels on the fly, which allow the Pixy2 to continuously track the sun through dramatic changes in intensity, with a white weather balloon sometimes in view as well. The payload will include a filter wheel in front of the main camera, to allow it to be covered with a solar filter when the sun is bright and uncovered when the sun is fully eclipsed. The payload may also include occulting disk(s) to shadow the main camera, to try to generate a "synthetic eclipse." Flying such a solar chronograph during an actual solar eclipse would provide evidence, using the same camera system, that it is possible to study the solar corona from any balloon flight that gets above the Rayleigh scattering of the sky and can reliably point a camera and occulting disk at the sun.

Type of Presentation: Poster

Presentation Session/Order: P2

Presentation Link: https://youtu.be/Q9Gfh9QoXgY

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Soft Skills Involved With NEBP

Lily Trujillo, Ashlinn Stoneking, Lucus Cooper

Casper College/Kelly Walsh HS/Natrona County HS, Casper, WY

The Nationwide Eclipse Ballooning Project is primarily focused on the eclipse and the data associated with it. However, the path toward gathering this information involves the curation of soft skills that cannot be refined in a classroom setting. Many individuals involved have not had hands-on experience in this context, so navigating this project develops management skills while still providing structure through the lessons from Montana State University. The Engineering Track specifically tests a teamÕs problem solving skills by providing an end goal and leaving the path open-ended. As a group is working towards a common goal, skills such as communication become a necessity as do organizational skills as well. Essentially, a project that mirrors a "real-life" work environment is more effective at fostering those skills by making them necessary to succeed. The Wyoming Space Engineers (WySE) developed these skills up to the annular eclipse and after, through consistently working on improving the systems involved with the balloon. In addition to the skills improved solely by the process of designing the balloon, this project goes beyond just the balloon into skills such as outreach and public speaking to gain materials and public support. As these proficiencies grow, their application extends beyond the NEBPÕs boundaries, shaping individuals to excel in a plethora of fields with a diverse skill set.

Type of Presentation: Poster

Presentation Session/Order: P2

Presentation Link: https://youtu.be/Q9Gfh9QoXgY

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Gravity Wave Analysis with GPS Data

Bryce Kim and Randy Larimer

Montana State University, Bozeman, MT

Atmospheric gravity waves have conventionally been studied and characterized using temperature and wind data from radiosondes. In this study we outline and adapt several previously established wave-detection methods for use with solely high-resolution position and velocity measurements from student-constructed GPS units. We consider both vertical and horizontal profiles, utilizing Fourier, hodograph, and polarization analyses, which primarily target low-frequency inertia gravity waves. Using thirteen balloon flights over central Montana and New Mexico conducted during 2021 - 2023 summers by the Balloon Outreach Research Exploration and Landscape Imaging Systems (BOREALIS) program, including the annular eclipse in October 2023, we show the validity of our procedures in successfully locating inertia gravity waves and finding wave parameters consistent with those of existing studies. A total of eleven waves were found in seven of the non-eclipse flights, with the same wave likely showing up more than once in two flights. Meanwhile, at least two waves were found in data from flights occurring during the eclipse. Properties of these eclipse waves remained similar across multiple datasets, further reaffirming our methods. The detected waves generally had intrinsic frequencies of one to two times the Coriolis frequency, spanned vertical wavelengths between one and three kilometers, and had periods of between 10 and 15 hours.

Type of Presentation: Poster
Presentation Session/Order: P2
Presentation Link: https://youtu.be/Q9Gfh9QoXgY
NEBP affiliation (if any): NEBP Engineering (videostreaming) team
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Expectations Versus Reality: Overcoming High Altitude Balloon Obstacles During the Annular Solar Eclipse

Amber Tannehill

University of Nebraska-Lincoln, Lincoln, NE

The University of Nebraska-Lincoln had a team of students participate in the Nationwide Eclipse Ballooning Project, which launched during the annular solar eclipse. The launch was ultimately successful, but we experienced a great deal of obstacles leading up to this launch, some of which even needed to be solved on the spot. Some of those major barriers included re-making and testing the balloon vent, losing the first balloon during the eclipse launch, and the strangeness of the recovery after the eclipse.

First, we had to do many re-designs during the initial planning and testing phases before the high altitude balloon launches could even begin. We initially obtained a 3D printed vent from another university and used it to practice the methods of venting and cutting down the balloon. However, the cut down didnÕt work and parts of the vent broke off upon impact - forcing us to re-print the vent and go through a series of different tests before we arrived at our final version. During the annular solar eclipse launch we encountered another frightening problem as we were filling up the balloon. Although we performed all of the pre-launch steps according to plan, we had the balloon slip off of the vent when it was half full and fly off before we were able to catch it. Luckily it didnÕt take any of the payloads with it, and we had brought a backup balloon, allowing us to retie it onto the vent and launch with only seconds to spare until our launch window ended. Finally, when we recovered the payloads after the eclipse, we found that the balloon was still attached, which had never happened to us before. This made it easy to spot in the field, but a bit more difficult to recover the payloads themselves.

Type of Presentation: Lightning talk

Presentation Session/Order: L2A

Presentation Link: https://youtu.be/TcY1brt3fRA

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Reflection from Socorro NM surrounding the Oct 14th 2023 Annular Eclipse

Susan Adewale, Kadiatu Kaya, Abby Conrad, Bronwyn Hicks, Erick Agrimson

St. Catherine University, St. Paul, MN

High-altitude balloons (HABs) are helium-filled latex weather balloons used as a delivery system for tropospheric as well as stratospheric atmospheric experiments. HABs were used by the eclipse ballooning collaborative team from Saint Catherine University (St.CU), Saint Cloud State University (SCSU) and Fond du Lac community and Tribal College (FDLTCC) to measure changes in the atmospheric environment during the October 14th 2023 annular eclipse. Attached to each HAB was a small parachute and a radiosonde. The radiosonde sends down atmospheric measurements via antenna to a ground station housed in a pelican case which in turn communicates data to a laptop via a USB cable. Atmospheric measurements such as temperature, relative humidity, wind direction, GPS location are some of the many items that can be monitored with the GRAW software. Balloons were flown every hour on the hour from the receiving yard of our host the New Mexico Institute of Mining and Technology in Socorro New Mexico. This run is a study of solar effects on atmospheric conditions conducted in preparation for the total solar eclipse of 2024. The data collected is still being looked at by our university, so in this talk we present an overview of what worked well for the St. Kate's team, what can be improved, a thank you to New Mexico Institute of Mining and Technology for hosting us and some of our photographs from our experience in New Mexico during the Annularity event.

Type of Presentation: Lightning talk

Presentation Session/Order: L2B

Presentation Link: https://youtu.be/lQfnMVKIyFw

NEBP affiliation (if any): NEBP Atmospheric Sciences (radiosonde) team

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Eclipse Video-Streaming with a Cell Phone and Eclipse Observing with a Sunspotter Telescope: Outreach Recommendations from the U of MN Ð Twin Cities NEBP Team

James Flaten and Ashton Posey

U of MN - Twin Cities, Minneapolis, MN

The Nationwide Eclipse Balloon Project (NEBP) expects all teams to engage in eclipse-themed outreach, in addition to conducting their ballooning campaigns. This presentation will discuss two successful outreach activities conducted by the U of MN Ð Twin Cities NEBP team: one planned and one spontaneous, one which requires additional equipment and one which only uses equipment that all NEBP teams have (eclipse glasses and cell phone cameras), both of which can be taught and shown to attendees quickly, and both of which can be practiced and used for solar observing in non-eclipse, non-ballooning contexts. The any-team-can-do-it activity, which was tried by a team member for the first time during the annular solar eclipse in October 2023, involved covering a cell phone camera lens with a solar filter (i.e. with eclipse glasses) then adjusting the camera settings to be suitable for solar observing (the details will vary between different types of cell phones, but we can give you pointers about what to try and this is something you can ground-test in advance) then live-streaming the eclipse to Instagram. The planned activity, which was the biggest hit of all the outreach we tried, involved observing the eclipse using a Sunspotter Solar Telescope. This triangular-shaped, folded-Keplerian telescope is exceptionally easy to point, projects a sizeable image of the sun onto a piece of paper, and has open sides so that multiple people can simultaneously view the image without having to take turns looking through an eyepiece. Most vendors sell the Sunspotter Solar Telescope about $500, but it can often be found for about $350 - sometimes even less.

Type of Presentation: Lightning talk

Presentation Session/Order: L2C

Presentation Link: https://youtu.be/y6P5qXl0zyk

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Effect of High Altitude Radiation On Brassica rapa Flown In The Stratosphere On Weather Balloons

Kadiatu Kaya, Susan Adewale, Abby Conrad, Bronwyn Hicks, Rahul Roy, Erick Agrimson

St. Catherine University, St. Paul, MN

Astrobiology is the scientific study of life beyond Earth and the universe. We focused on cosmic radiation to investigate its impact, particularly in spaceflight, where plant seeds might be exposed to high-altitude radiation. The significance lies in the potential cause of radiation induced DNA damage and effect on germination processes when these seeds are back on land for germination at space stations or lunar/Martian bases. Our research focused on investigating the effects of cosmic radiation, specifically neutron radiation on Wisconsin Fast Plants (Brassica rapa) seeds and seedlings. Space-high-altitude radiation poses a challenge, such as DNA damage to seeds due to radiation exposure of these seeds. This damage, in turn, can slow the growth and development of the seeds and food produced. Our experiment involved the exposure of B. rapa seeds to neutron radiation during a high-altitude flight on weather balloons. The experimental setup included a payload with a neutron tube, a Go-pro camera, seeds and GPS trackers. Following a four-week germination period post-flight, we measured the root and stem lengths, germination percentages, and other plant growth parameters. Initial observations showed potential differences between the flight-exposed seeds and the ground control. However, further experiments and statistical analyses will draw conclusive insights from the data. This research highlights the interplay between cosmic radiation, spaceflight, and plant seeds' germination and growth processes. The findings hint at potential implications for future space agriculture success and highlight the need for further study in astrobiology.

Type of Presentation: Lightning talk

Presentation Session/Order: L2D

Presentation Link: https://youtu.be/rtYXBy1jN70

NEBP affiliation (if any): HAB biology research

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The Evolution of Field Campaign Roles & Responsibilities on a Tribal College High Altitude Ballooning Team

Danny Johnson and Drew Grennell

Salish Kootenai College, Pablo, MT

To perform a successful scientific field campaign as part of a team, each member must fulfill their role efficiently and effectively. As a participant in the Nationwide Eclipse Ballooning Project, (NEBP) members of the Salish Kootenai College Ballooning Eclipse Team (SKC BET) worked in groups of four with each member working in a specific role including: Ground Station, Weather Station, Primary Fill, and Secondary Fill. This presentation will describe the evolution and optimization of the characteristics and responsibilities of each role from the time the team first started practicing launches in August 2023, until after the October 2023 annular eclipse. Some tools that led to our success were an abundance of meetings, which provided ample opportunity to share ideas. We created an environment where everyone felt respected and heard. We prioritized practice launches simulating the variety of conditions we would experience in the field. Through repetition and a willingness to try different ideas, we developed a suite of techniques and strategies that led to a successful campaign. During this discussion weÕll examine how we fostered a culture where the best ideas won the day, and what some of those ideas were. We hope these strategies can help all teams support the unique attitudes, personalities, and strengths of their student teammates.

Type of Presentation: Lightning talk

Presentation Session/Order: L2E

Presentation Link: https://youtu.be/x-pQTCiqMwM

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High Winds and Brittle Vents

Jacob Morgan

Eastern Michigan University, Ypsilanti, MI

A team from Eastern Michigan University launched a high altitude weather balloon near Albuquerque, New Mexico, during the annular solar eclipse on October 14, 2023. We report on some interesting results from this test launch. Intense vertical winds were observed during the ascent which seem to be caused by an updraft due to the mountainous area. Additionally, the ventilation system during the flight was unresponsive, and after recovery, the vent system was found to be completely destroyed. We also found that the ventilation system sheared cleanly at the neck and that the neck itself was unable to be located during recovery, suggesting that the break happened at altitude, possibly due to a collision between payloads. We believe the shear happened at the location of maximum stress on the vent, which at this point became brittle due to the cold temperatures. These two incidents suggest that further analysis and testing of the ventilation system is required and launch procedures need to be modified to account for dynamic weather conditions prior to the next balloon launch. This presentation will cover more in detail what the weather balloon encountered in Albuquerque, New Mexico, and the testing that the Eastern Michigan University team has planned for the ventilation system.

Type of Presentation: Lightning talk

Presentation Session/Order: L2F

Presentation Link: https://youtu.be/EYpvV9U1F-4

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Mission Success through Collaboration

Patrick Donato, Dylan Harter, Leigha Schrader, Jeivian Ramos Torres, Dr. Jesse McTernan, Dr. Sven BilŐn

Penn State University, State College, PA

Mission success can be facilitated or enabled through strategic partnerships and collaboration. Penn StateÕs Nationwide Eclipse Ballooning Project (NEBP) team experienced this during the campaign to Albuquerque, New Mexico for the annular solar eclipse on October 14th, 2023. This was the teamÕs first untethered launch of a high-altitude balloon, achieving mission objectives of a target altitude of 70,000 feet (approximately 21 km), successful tracking and recovery, and partially achieving mission objectives of collecting atmospheric data and video. The most important lesson the team learned was that key partnerships are enabling and transformative to mission success. A physics professor at UNM served as the teamÕs liaison connecting them with decision makers at the launch site, provided workspace for the entire duration of the mission, provided storage for helium and other supplies, and facilitated critical logistics such as housing. The professor integrated the teamÕs efforts into an existing event organized by the Physics Department, thus creating a winÐwin scenario. Our mission was advertised to the public as an additional incentive to visit the eventÑincreasing the outreach potential and publicity for the university and department. Following the launch, it was a collaboration with a rancherÕs neighbor that enabled the team to recover the payload. The team learned that collaboration could come from unexpected sources. Another lesson learned was that it is very difficult to focus on technical tasks while answering questions from visitors and spectators. Therefore, the team will use collaboration to achieve the mission objective of outreach and education by partnering with students and faculty from the University of Northern Texas during the total solar eclipse campaign on April 8th, 2024. Together, they will develop a plan to both fully engage in outreach and fully focus on launch protocol during setup, launch, and execution.

Type of Presentation: Lightning talk

Presentation Session/Order: L2G

Presentation Link: https://youtu.be/XJtqrJONQws

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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Video Streaming with the Raspberry Pi 5

Noah Lambert, Benjamin Mock, Aedan Bryant, Karun Varghese

University of Maine, Orono, ME

This project focuses on investigating the possibility of updating existing video streaming using a Raspberry Pi 5 with dual camera ports. The current testing state shows some trade-offs between the existing ArduCam based system and a Raspberry Pi 5. The software setup and power supply remains the same, with a single command to run the install script, and using the existing Montana power board and batteries. Power requirements are slightly more for the Raspberry Pi 5. Dual camera ports allow the Raspberry Pi 5 to send two independent and parallel streams to the ground station which eliminates the need for an additional hat, but requires more bandwidth for the same resolution as the previous system. Video processing & stitching at the ground station is still required but the two independent streams remove the need to split the incoming ArduCam video. The old cameras are not compatible with the Raspberry Pi 5. Therefore, modifications would need to be made to the existing camera mounts to point in the desired location. The Raspberry Pi 5 has a real-time clock, powered by a coin battery, allowing us to correctly timestamp files, a feature the Raspberry Pi 4 did not have. Overall, the functionality of the Raspberry Pi 5 for video streaming closely mirrors that of the Raspberry Pi 4 setup.

Type of Presentation: Standard talk

Presentation Session/Order: S4A

Presentation Link: https://youtu.be/ePzmUqmz-6I

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Development of the HERMES Ground Station Pointing GUI for NEBP Eclipse Ballooning Teams

Jesse Cook

U of MN - Twin Cities, Minneapolis, MN

When studying solar eclipses from stratospheric balloon flights, it is of some interest to live-stream the view from on-board camera(s). The Nationwide Eclipse Ballooning Project (NEBP) has developed a standardized payload consisting of a Raspberry Pi and dual-mounted cameras capable of live-streaming footage to a ground station through a Ubiquiti modem telemetry link. The ground station must be able to track the balloon and robustly point its antenna at the payload in real time. The original BRAD ground station software, developed at Montana State University, uses an in-flight Iridium modem to relay the gps location of the payload to the ground station via the Internet. The Helios Eclipse Remote Monitoring and Examination System, or HERMES, is alternative ground station software developed at the University of Minnesota Ð Twin Cities. It is a purpose-built user interface designed to track a ballooning payload and to also display a livestream from onboard cameras in real time. HERMES can receive balloon gps data from three independent sources (Iridium, aprs, and RDF900) simultaneously (and much more frequently than using Iridium alone) and, using a weighted average, calculate pointing angles for the ground station dish. HERMES also includes a suite of visual elements, a mission clock, telemetry data logging, screen recording, the option to send venting and cut-down commands, plus additional features. The HERMES software is available for adoption by NEBP teams for use during eclipse balloon flights (and other balloon flights) attempting to do live-steam video telemetry.

Type of Presentation: Standard talk

Presentation Session/Order: S4B

Presentation Link: https://youtu.be/ZokvbMqUDaY

NEBP affiliation (if any): NEBP Engineering (videostreaming) team

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The Sun is Dead - Respecting Local Cultures

Peggy Norris

South Dakota School of Mines and Technology, Rapid City, SD

The South Dakota Eclipse Balloon Team was based in the Four Corners area of northwest New Mexico for the 2023 annular eclipse. The area is near the land of two tribes (Navajo and Ute) who have strong traditions about eclipses. It was a learning experience for all of us, especially our students, to communicate with local Navajo about their beliefs. In the Navajo (Dine) language, the word for eclipse means Ôthe death of the sunÕ and is considered a sacred time of rebirth. The Navajo Nation closed national parks on their lands and many local businesses so that tribal members could stay inside and pray during the period from First to Fourth Contact. The South Dakota team determined that they needed to be on Navajo Nation land to launch the balloons in order to be over Farmington during annularity. We will discuss the care that was taken to obtain appropriate permissions and to respect Navajo tradition as we launched our balloons from their land. This concern filtered over to an outreach event at a local Navajo high school. The author was sensitive to the traditions and did not show any pictures of eclipses, instead focusing on the balloons and instruments themselves. The students were quite interested to hear that the team included two Lakota high schools, and that not all tribes had the same traditions.

Type of Presentation: Standard talk
Presentation Session/Order: S4C
Presentation Link: https://youtu.be/Ikuzz5v0QuU
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GPS Differential Radiosonde Tracker

Conner Murray, Cole Linder, Sarah Miller, Darick Carney

Gordon Cooper Technology Center, Shawnee, OK

Essentially, all radiosondes are currently being tracked with two-dimensional GPS mapping software such as SondeHub. The current means of tracking are efficient at high altitudes, but they are lacking as the balloon approaches the ground, which is the most important part of the flight for recovery. This inefficiency, caused by the loss of line of sight, leads to many of the approximately 1400 radiosondes that are launched every day being lost. This project set out to create a means of verifying a physical line-of-sight between a balloon chaser and a radiosonde. This is important because line-of-sight is necessary for maintaining signal connection when tracking radiosondes, and there is not currently a means of doing this. This project serves as a three-dimensional compass that always points in the direction of the radiosonde. It has onboard radiosonde tracking and local GPS capabilities, and the whole system consists of a laptop with a listening program, an Arduino microcontroller, a serial adapter, a nine-axis compass sensor, two servos, and an arrow attached to a swiveling base. The tracker has successfully picked up a radiosonde signal at approximately mid-flight and made adjustments for heading and physical location to maintain accuracy. The tracker is extremely easy to follow as it simply points in the direction of the radiosonde, and this means it requires essentially no navigational skills to operate. It is also a great addition to any chase vehicle, as a quick glance at the direction of the arrow can guide the chaser.

Type of Presentation: Standard talk
Presentation Session/Order: S4D
Presentation Link: https://youtu.be/1I_BKoe-hKw
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Dual Index: by First Name of First Author and by Institution