Arizona NASA Space Grant Consortium
33rd Annual Statewide Student Research Symposium

Presentations by Space Grant Students from:

Arizona State University
Embry-Riddle Aeronautical University
Northern Arizona University
University of Arizona
Arizona Western College
Casa Grande Union High School
Central Arizona College
Glendale Community College
Phoenix College
Pima Community College

April 20th, 2024
Tucson, AZ

Arizona NASA Space Grant Consortium

33rd Annual Statewide Student Research Symposium

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2023-2024 Arizona NASA Space Grant Consortium
Statewide Student Research Symposium
April 20, 2024

Welcome to the 33rd annual Arizona NASA Space Grant Statewide Student Research Symposium!

The Symposium consists of a student poster session, four parallel topical sessions, a morning break for coffee, afternoon lunch, and refreshments at the end of the day. We encourage you to use these breaks to network with one another, talk to peers and colleagues from other schools, and take time to make connections.

The Symposium will feature talks from 178 students, with 3 students represented "In Title Only". In-person talks will typically last ten minutes each, roughly divided as ~8 minutes for presentations and ~2 minutes for questions from the audience.

This symposium is made possible through a NASA grant awarded to the Arizona Space Grant Consortium. The efforts of managers, mentors, steering committee members and Space Grant representatives at Arizona State University, Embry-Riddle Aeronautical University, Northern Arizona University, the University of Arizona, Arizona Western College, Casa Grande Union High School, Central Arizona College, Glendale Community College, Phoenix College, and Pima Community College are acknowledged. Students with a variety of academic backgrounds have come together with their mentors to make the program a success, and this Symposium is a tribute to their dedication and spirit of inquiry.

The Arizona NASA Space Grant Student Research Symposium also recognizes the efforts of many university faculty, private sector, and federal researchers/mentors, who give selflessly of their time and energy to provide leading-edge research experiences to enrich the education of Arizona's Space Grant students. We thank them all for their past, present and future support.

Timothy Swindle, Director
Arizona Space Grant Consortium, UArizona

Michelle Coe, Program Manager
Arizona Space Grant Consortium, UArizona

Chandra Holifield Collins, Associate Director
UArizona NASA Space Grant

Yancy Shirley, Assistant Director
UArizona NASA Space Grant

Thomas Sharp, Associate Director
ASU NASA Space Grant

Desiree Crawl, Sr. Coordinator
ASU NASA Space Grant

Anne Boettcher, Associate Director
ERAU NASA Space Grant

Elliott Bryner, Associate Director
ERAU NASA Space Grant

Christopher Edwards, Associate Director
NAU NASA Space Grant

Paloma Rose Davidson, Assistant Program Manager
NAU NASA Space Grant

Saturday, April 20, 2024, Hilton Tucson East

8:30-8:50 AM: WELCOME & INTRODUCTION

ROSEWOOD BALLROOM

8:50-9:30 AM: ASCEND POSTER SESSION

ROSEWOOD BALLROOM

Room	Ocotillo B	Prickly Pear	Mesquite B	Cactus Flower
TIME (MST)	**Session A** ASTRONOMY & SPACE PHYSICS **Moderators:** Yancy Shirley, UA Tim Swindle, UA (9:40 AM – 3:50 PM)	**Session B** EARTH & ENVIRONMENTAL SCIENCE/ENGINEERING **Moderators:** Christopher Edwards, NAU Chandra Holifield Collins, USDA-ARS (9:40 AM – 2:40 PM) --- **Session C** AERONAUTICS **Moderators:** Elliott Bryner, ERAU Thomas Sharp, ASU (2:40 PM – 3:20 PM)	**Session D** PLANETARY SCIENCE **Moderators:** Sarah Sutton, UA Thomas Sharp, ASU (9:40 AM – 12:00 PM) --- **Session E** EXPLORATION SYSTEMS ENGINEERING: BIOLOGICAL, MATERIALS, OPTICAL, AND ELECTRICAL **Moderators:** Jonathan Adams, ERAU Michele Zanolin, ERAU (12:00 PM – 3:40 PM)	**Session F** EDUCATION & PUBLIC OUTREACH **Moderators:** Anne Boettcher, ERAU Paloma Rose Davidson, NAU (9:40 AM – 11:50 AM) --- **Session G** AEROSPACE TECHNOLOGY: SPACEFLIGHT & ENGINEERING PROGRAMS **Moderators:** Anne Boettcher, ERAU Elliott Bryner, ERAU Ron Madler, ERAU (11:50 AM – 3:10 PM)

Room	Ocotillo B	Prickly Pear	Mesquite B	Cactus Flower
9:40-9:50	[A-1] *Brandon Pillon, Charles Wszalek* Noise Reduction in Low Frequency LIGO Detectors	[B-1] *Embrey Saville* The Relationship Between Biological Soil Crust, Extracellular Polymeric Substances, and Soil Erosion on Varying Substrates to Investigate Biosignatures on Mars	[D-1] *Greta Freeman* Mapping Mounds in Utopia Planitia to Investigate the Origins of Martian Volcanic Features	[F-1] *Calvin Henggeler, Logan Ruddick* Project Management Practices for Undergraduate Space Projects
9:50-10:00	[A-2] *Naomi Carl* Star Formation History of NGC 3344	[B-2] *Liam Falk* Airborne and Aquatic Micro-Nano Plastic Detection by Machine-Learning-Assisted Multispectral Imaging and Micro-Channel Flow Assays	[D-2] *Travis Matlock* Mapping Martian Crustal Magnetic Anomalies	[F-1] *Calvin Henggeler, Logan Ruddick* Project Management Practices for Undergraduate Space Projects
10:00-10:10	[A-3] *Jack Kohm* Dark Matter Models and Their Impact on Stellar Stream Morphology	[B-3] *Elyssa Baker* Groundwater Monitoring Assessment at the Falls City, Texas Uranium Tailings Disposal Site	[D-3] *Lucienne Morton* Post-Mid-Size Asteroid Impact Long-term Flooding Hazards	[F-2] *Matthew Marquez* Exploration of ChatGPT as a Research Tool for Exoplanet Detection and Analysis
10:10-10:20	[A-4] *Kya Schluterman* Distributional Methods for Detecting Supernova Gravitational Waves	[B-4] *Abigail Haan* Intermittent and Continuous Operation of an Off-Grid Solar Nanofiltration System	[D-4] *Rachel Fry* Analysis of Dust Produced by Experimental Aeolian Transport of Mars-Analog Sands	[F-3] *Madison Marie Easton* The Science of Storytelling: Science Journalism at the Arizona Daily Sun
10:20-10:30	[A-5] *Xander McLendon, Clyde Miller* Mass Transfer Analysis of Ultracompact X-ray Binary Systems	[B-5] *Cameron Fuse* Wildfires Working to Release and Remobilize Contaminants in Rural Arizona	[D-5] *Conor Earley* Atmospheric Revelations: Probing Exoplanets Composition and Structure Through Innovative Instrumentation	[F-4] *Penny Duran* Scientific Writing at UArizona's University Communications
10:30-10:40	[A-6] *Eyan Weissbluth* Examining the Stellar Population of NGC 3344	[B-6] *Alexis-Marie Parrish* Vegetation Monitoring at LM Sites	[D-6] *Dora Elalaoui-Pinedo* Mapping Enigmatic Pits in the North Polar Layered Deposits of Mars	[F-5] *Lindsey Tober* Space For Humans
10:40-10:50	[A-7] *Miriam Biehle* Analyzing Standing Accretion Shock Instability using Gravitational Wavescanva	[B-7] *Gabriella Garza* Tamarisk and Mycorrhizal Fungal Associations in Salix exigua	[D-7] *CGUHS ASCEND* Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation	[F-6] *Katrina Robertson* Bridges to Belonging
10:50-11:10	**MORNING BREAK & REFRESHMENTS IN FOYER**			

11:10-11:20	[A-8] *Noah McLeod* Galaxy Morphology of PEARLSDG	[B-8] *Victoria Lang* Ice Cloud Parameterizations for the Global Climate Models	[D-8] *Olivia Vester* Building Computational Models to Understand The Interplay Between Climatic Factors, Air, Transportation, and Infectious Disease Dynamic	[F-7] *Virginia Crook* Digitizing Eugene Shoemaker's Legacy
11:20-11:30	[A-9] *Taylor Brown, Shannon Moore* Analyzing the Variability and Orbit of Massive Binary Eta Carinae	[B-9] *Hayden Ferrell* Cell Size and Temperature	[D-9] *Cameron Hrabak* Photosynthetic Potential on TRAPPIST-1e: Modeling for Exoplanetary Life	[F-8] *Sam Campbell* Making Meteorites Accessible
11:30-11:40	[A-10] *Taylor Kalish* An Investigation of the Motion of Young Stellar Objects in NGC 1977, with a Focus on Externally Photoevporating Planet Forming Disks	[B-10] *John Esparza* Earthworks and Ecosystems: A Web-Based Tool for Vegetation Monitoring in the Altar Valley	[D-10] *Emily Clark* Space Weathering of Dark Regolith and Carbonaceous Asteroids	[F-9] *Alexandra Kupersmith* Mars in 3D: Creating Accessible Planetary Science Education
11:40-11:50	[A-11] *Sebastian Montano* Dust Continuum Analysis of Distant Galaxies through Simulations of ALMA Observations	[B-11] *Erin Burgard* Inducing Pressure on Space Perovskite Solar Cells	[D-11] *Jessica Maldonado* Optimization of Lunar Map Distortion	[F-10] *Kayla Blair* Developing NAU's First Undergraduate Science Communication Course
11:50-12:00	[A-12] *Derrick Drango* Unveiling the Secrets of Neutron Stars; X-ray Astronomy with Spectro-timing Analysis	[B-12] *Tatum Hardt* Sedimentary Analysis of Eklutna Lake, Alaska, to Understand Glacier Fluctuations Over the Past 9,600 Years	[D-12] *Ritisha Das* Investigating the Cause of Mars' Large Volcanoes from Deep Mantle Convection	[G-1] *Chance Lawrence* Continuously Integrated Raster Scan Algorithm for Microwave Antenna Holography
12:00-12:10	[A-13] *Tristen Shields* Fitting Density Profiles of Dynamical Dark Matter Halos	[B-13] *Garret Wilson* Protein Domains with Unbalanced Amino Acid Usage are Differentially Lost	[E-1] *Nathan Bleakley, Winona Roulston* Investigation of Stress Concentrations in Fused Deposition Modeled Parts	[G-2] *Sarah Li* CatSat: Ground Station Assembly & Mission Operations
12:10-12:20	[A-14] *Sarah Saavedra* Analyzing Dust in Distant Galaxies	[B-14] *Jessica Condon* Remote Sensing for Yellowstone Geothermal Area Characterization	[E-2] *Chad Cantin* NASA Surveyor Program: Surveyors 1, 3, 5, 6, and 7	[G-3] *Walter Rahmer* CatSat: Preparing for CubeSat Flight Operations and Science
12:20-12:30	[A-15] *Hanga Andras-Letanovszky* A Formaldehyde Deuteration Survey of Dense Starless Cores in Taurus	[B-15] *ASU ASCEND* Analysis of Extraterrestrial Radiation's Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload	[E-3] *Henry Garland* Transparent Conductive Oxides for Quantum Optical Devices: A Computational Approach	[G-4] *Sam Bevier* Exploratory Study on Wind Tunnel Noise Profiles

12:30-1:50	**LUNCH IN ROSEWOOD BALLROOM**			
1:50-2:00	**Transition from Lunch to Breakout Rooms**			
2:00-2:10	[A-16] *David Polk* Calibrating the ATLAS Calorimeter using Single Particle Interactions with Machine Learning	[B-16] *Kayshavi Bakshi* Manufacturable & Robust Perovskite Solar Devices for Space	[E-4] *Juan Machado Jr.* Comparison of In-process Distortion for Metal Additive Manufacturing Processes Using Simulations	[G-5] *Nikhil Dave, Tyler Thurman* Embedded Software Development on the EagleSat 2 Memory Degradation Experiment
2:10-2:20	[A-17] *Ahmad Qureshi* Digital Analysis of Ionospheric Plasma On-board Waves, Instabilities & Noise Spectrometer (WINS)	[B-17] *Ethan Johnson* Dielectrophoretic Characterization of Micron-Sized Mineral Particles	[E-5] *Mitchell Todd* Optimization of Inverse Kinematics with Deep Learning	[G-6] *James Felder* Satellite Research
2:20-2:30	[A-18] *Colton Quirk* Analyzing Archival FIMS/SPEAR Data to Construct a Far-Ultraviolet Background Map	[B-18] *Simon Fronmueller* A Tale of Two Trace Metals: A Yellowstone Mystery	[E-6] *Michael Villasana* Smart Sandbag for Autonomous Lunar Construction	[G-7] *Gabriel Negrao* 3-D Printed Afterglow Filters for Air Pollution Control
2:30-2:40	[A-19] *Hannah Gruber* A Comparative Deuteration Survey of Starless Cores	[C-1] *Ryan Oppen* Design of Actuated Systems for Flying Machines	[E-7] *Samantha Beauchaine* Iron Meteorite Imaging and Database	[G-8] *Rachel Rhomberg* Pneumatic System Integration in Supersonic Flow
2:40-2:50	[A-20] *Dare Bartelt* Measuring the Atmosphere of the Hot Jupiter WASP-43b with Gemini-S/IGRINS	[C-2] *Kylee Bennett, Davy Stanfield Brown* Characterization of the Effects of Sweep at Low Reynolds Number	[E-8] *Leonel Almanzar* Implantable Bone Sensors to Monitor Fracture Healing	[G-9] *Kyle Newlin* Trajectory Optimization for Shuttle Via Earth-Mars Cycler Orbit
2:50-3:00	[A-21] *Rafael Ortiz* PEARLS: Discovery of Intermediate Redshift Seyfert-like Galaxies with Unique PSF-Features in their Cores Throughout the North Ecliptic Pole Time Domain Field	[C-3] *Veer Nayyar* Flow Temperature Characterization of a Mach 5 Wind Tunnel	[E-9] *Selena Lamborn* Thin Films For Use in Quantum Networking: Effect of P-type Doping on Spin Coated ITO Thin Films	[G-10] *Genevieve Cooper* Deployable Optical Receiver Aperture (DORA)
3:00-3:10	[A-22] *Jake Summers* Searching for Red Rings from Weak AGN with JWST NIRCam	[C-4] *Lina Youssfi* Aerospace Alloy Advancements	[E-10] *Breck Meagher, Zachary Traynor* Bathymetric LiDAR: Investigation of Optimal Visible Light for Non-Ideal Aquatic Environments	[G-11] *Alondra Cardona* Aspera Space Mission Science Targets and Analysis

3:10-3:20	[A-23] *Aurora Wilde* A Survey of Singly-Deuterated Ammonia in Prestellar Cores in the Taurus Molecular Cloud	[C-5] *Anyell Mata* Autonomous High-Altitude Balloon Payload	[E-11] *Sarina Blanchard* Waves, Instabilities, & Noise Spectrometer (WINS) for Earth's Ionosphere	
3:20-3:30	[A-24] *Sola Nova* Be Stars: Lambda Pavonis		[E-12] *Grace Morris* Development of Machine Learning Assisted Surrogate Models for Complex Space Structures	
3:30-3:40	[A-25] *Hunter Brooks* Photometric and Astrometric Properties of Ultracool Subdwarfs		[E-13] *Saket Shanbhag* FPGA-based RADAR Signal Processing	
3:40-3:50	[A-26] *Nicolas Mazziotti* Utilizing Citizen Science to Identify Diffuse Galaxies			
3:50 -	**AFTERNOON REFRESHMENTS, EVALUATIONS & NETWORKING IN FOYER**			

Program Schedule by Session

Session NEBP: Nationwide Eclipse Ballooning Project

ASCEND Poster Session

[NEBP-5] **Arizona South NEBP team**. Student: Razak Adamu, Sophomore, Aerospace Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[NEBP-5] **Arizona Nationwide Eclipse Ballooning Project**. Student: Courtney Banks, Senior, Computer Science, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[NEBP-5] **Arizona South NEBP Team**. Student: Sarina Blanchard, Junior, Mechanical Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[NEBP-5] **Arizona South NEBP Team**. Student: Colin Brown, Sophomore, Optical Sciences and Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[NEBP-5] **Tracking Stratospheric Payloads**. Student: Tyler Derrick, Sophomore, Aerospace Engineering, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[NEBP-5] **Arizona Eclipse Ballooning Project**. Student: Jacqueline Do, Sophomore, Electrical Engineering, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[NEBP-5] **Nationwide Eclipse Ballooning Project South**. Student: Andrew Kwolek, Senior, Systems Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[NEBP-5] **Stratospheric Stories: Arizona Eclipse High Altitude Ballooning**. Student: Megan Miller, Sophomore, Astrophysics, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[NEBP-5] **Arizona Eclipse Ballooning Project**. Student: Everett Moore, Junior, Aerospace Engineering, Astrophysics, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[NEBP-5] **Arizona South NEBP Team**. Student: Vaidehi Pujary, Junior, Electrical and Computer Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[NEBP-5] **Atmospheric Phenomena Analysis during Solar Eclipses by the Arizona South Team: A Study of Environmental Changes and Video Recording at High Altitudes**. Student: Muhammed Hunaid Topiwala, Sophomore, Computer Science (Software Engineering), Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[NEBP-3] **Eclipse Balloon Project**. Student: Mackenzie Shughart, Senior, Mechanical Engineering (Propulsion), Embry-Riddle Aeronautical University. Mentors: Kathryn Wesson, Applied Aviation Sciences, and Yabin Liao, Aerospace Engineering, Embry-Riddle Aeronautical University

Program Schedule by Session

Session ASCEND:
Aerospace STEM Challenges to Educate New Discoverers

ASCEND Poster Session

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Sarina Blanchard, Junior, Mechanical Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Nicolas Blanchard, Post-Baccalaureate, Electrical and Computer Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Colin Brown, Sophomore, Optical Sciences and Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Ethan Chumley, Sophomore, Cyber Operations, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Arturo Lopez Jr., Sophomore, Aerospace Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Kane Mattison, First-Year, Aerospace Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Cameron Sacra, Sophomore, Studio Arts, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Edward Vanica, Junior, Aerospace Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-1] **UArizona ASCEND: High-Altitude Data Collection with a Custom CubeSat Payload**. Student: Divya Venkadesh, Senior, Aerospace Engineering, University of Arizona. Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona

[ASCEND-2] **Long-Distance Video and Telemetry Streaming**. Student: Somaralyz Grullon, Senior, Mechanical Engineering (Robotics), Embry-Riddle Aeronautical University. Mentor: Yabin Liao, Aerospace Engineering, Embry-Riddle Aeronautical University

[ASCEND-2] **Long-Distance Video and Telemetry Streaming**. Student: Chloe Reed, Senior, Aerospace Engineering, Embry-Riddle Aeronautical University. Mentor: Yabin Liao, Aerospace Engineering, Embry-Riddle Aeronautical University

[ASCEND-4] **Analysis of Extraterrestrial Radiation's Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload**. Student: Berkeley Adair, Junior, Aerospace Engineering, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[ASCEND-4] **Analysis of Extraterrestrial Radiation's Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload**. Student: Quang Huy Dinh, Sophomore, Aerospace Engineering, Aeronautic, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[ASCEND-4] **Analysis of Extraterrestrial Radiation's Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload**. Student: Tyler Nielsen, Junior, Computer Systems Engineering, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[ASCEND-4] **Analysis of Extraterrestrial Radiation's Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload**. Student: Els Shepard, First-Year, Aerospace Engineering, Astronautics, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[ASCEND-4] **Analysis of Extraterrestrial Radiation’s Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload**. Student: Joshua Sink, Sophomore, Aerospace Engineering, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[ASCEND-4] **Analysis of Extraterrestrial Radiation's Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload**. Student: Muhammed Hunaid Topiwala, Sophomore, Computer Science (Software Engineering), Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[ASCEND-4] **Analysis of Extraterrestrial Radiation's Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload**. Student: Ricardo Ontiveros, Junior, Electrical Engineering, Arizona State University. Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University

[ASCEND-6] **Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation**. Student: Zacheriah Buchanan, High School Student, Engineering, Casa Grande Union High School. Mentor: John Morris, Career and Technical Education, Casa Grande Union High School

[ASCEND-6] **Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation**. Student: Emily Geen, Junior, Engineering, Casa Grande Union High School. Mentor: John Morris, Career and Technical Education, Casa Grande Union High School

[ASCEND-6] **Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation**. Student: Landri Howard, High School Student, Software and App Design, Casa Grande Union High School. Mentor: John Morris, Career and Technical Education, Casa Grande Union High School

[ASCEND-6] **Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation**. Student: Melody Limon, High School Student, Engineering, Casa

Grande Union High School. Mentor: John Morris, Career and Technical Education, Casa Grande Union High School

[ASCEND-6] **Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation**. Student: Ethan Morgan, High School Student, Software and App Design, Casa Grande Union High School. Mentor: John Morris, Carrer and Technical Education, Casa Grande Union High School

[ASCEND-6] **Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation**. Student: Elijah Ramirez, Senior, Mechanical Engineering, Casa Grande Union High School. Mentor: John Morris, Carrer and Technical Education, Casa Grande Union High School

[ASCEND-6] **Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation**. Student: Aliceanna Villanueva, First-Year, Engineering, Casa Grande Union High School. Mentor: John Morris, Career and Technical Education, Casa Grande Union High School

[ASCEND-7] **GCC ASCEND, Team Icarus: Testing New Digital Sensors and Detecting UV Light**. Student: Octavian Englund, Sophomore, Computer Science, Glendale Community College. Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College

[ASCEND-7] **GCC ASCEND, Team Icarus: Testing New Digital Sensors and Detecting UV Light**. Student: Alejandro Reyes Villa, Senior, Aerospace Engineering, Glendale Community College. Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College

[ASCEND-7] **GCC ASCEND, Team Icarus: Testing New Digital Sensors and Detecting UV Light**. Student: Kevin Yonan, Junior, Computer Systems Engineering, Glendale Community College. Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College

[ASCEND-7] **GCC ASCEND, Team Icarus: Testing New Digital Sensors and Detecting UV Light**. Student: Mac Zapata, Sophomore, Science, Glendale Community College. Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College

[ASCEND-8] **GCC ASCEND Project 2: Payload Sensors and Live Data Transmission**. Student: Samirbek Islambekov, Sophomore, Computer Science, Glendale Community College. Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College

[ASCEND-8] **GCC ASCEND Project 2: Payload Sensors and Live Data Transmission**. Student: Matthew Sample, Sophomore, Electrical Engineering, Glendale Community College. Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College

[ASCEND-8] **GCC ASCEND Project 2: Payload Sensors and Live Data Transmission**. Student: April Sandoval, Sophomore, Computer Science, Glendale Community College. Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College

[ASCEND-8] **GCC ASCEND Project 2: Payload Sensors and Live Data Transmission**. Student: Adrian Yoder, Sophomore, Computer Science, Glendale Community College. Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College

[ASCEND-9] **Exploring Atmospheric Dynamics: A Collaborative Endeavor in Air Quality Research**. Student: Jose De La Torre Perez, First-Year, Systems Engineering, Arizona Western College. Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma

[ASCEND-9] **Exploring Atmospheric Dynamics: A Collaborative Endeavor in Air Quality Research**. Student: Areli Romero, Sophomore, Engineering, Arizona Western College. Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma

[ASCEND-9] **Exploring Atmospheric Dynamics: A Collaborative Endeavor in Air Quality Research**. Student: Alexandra Soto-Lopez, Sophomore, Electrical Engineering, Arizona Western College. Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma

[ASCEND-9] **Exploring Atmospheric Dynamics: A Collaborative Endeavor in Air Quality Research**. Student: Noah Torres, Junior, Welding, Arizona Western College. Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma

[ASCEND-9] **Exploring Atmospheric Dynamics: A Collaborative Endeavor in Air Quality Research**. Student: Anil Yamaner, Junior, Industrial Engineering, University of Arizona. Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma

[ASCEND-10] **Enhancing Launch Dynamics: Integrating Sensors and Stabilization for Advanced Atmospheric Analysis**. Student: Lorynn Garcia, Sophomore, Aerospace Engineering, Phoenix College. Mentor: Eddie Ong, Physical Sciences, Phoenix College

[ASCEND-10] **Enhancing Launch Dynamics: Integrating Sensors and Stabilization for Advanced Atmospheric Analysis**. Student: Garret Nordmeyer, Post-Baccalaureate, Engineering, Robotics, Phoenix College. Mentor: Eddie Ong, Physical Sciences, Phoenix College

[ASCEND-10] **Enhancing Launch Dynamics: Integrating Sensors and Stabilization for Advanced Atmospheric Analysis**. Student: Nathaniel Okafor, First-Year, Network and System Administration, Phoenix College. Mentor: Eddie Ong, Physical Sciences, Phoenix College

[ASCEND-10] **Enhancing Launch Dynamics: Integrating Sensors and Stabilization for Advanced Atmospheric Analysis**. Student: Rafael Sanchez, Sophomore, Mechanical Engineering, Phoenix College. Mentor: Eddie Ong, Physical Sciences, Phoenix College

[ASCEND-10] **Enhancing Launch Dynamics: Integrating Sensors and Stabilization for Advanced Atmospheric Analysis**. Student: Ryan Schmidt, Junior, Engineering, Phoenix College. Mentor: Eddie Ong, Physical Sciences, Phoenix College

[ASCEND-11] **Extraterrestrial Solar Power and Hydro Crystalline Structures**. Student: Timothy Akert, Sophomore, Mechanical Engineering, Pima Community College. Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College

[ASCEND-11] **Extraterrestrial Solar Power and Hydro Crystalline Structures**. Student: Matthew Arcarese, Junior, Electrical Engineering, Pima Community College. Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College

[ASCEND-11] **Extraterrestrial Solar Power and Hydro Crystalline Structures**. Student: Jordan Boe, Junior, Mechanical Engineering, Pima Community College. Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College

[ASCEND-11] **Extraterrestrial Solar Power and Hydro Crystalline Structures**. Student: Beau Carter, Sophomore, Optical Sciences and Engineering, Pima Community College. Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College

[ASCEND-11] **Extraterrestrial Solar Power and Hydro Crystalline Structures**. Student: Roberto Navarro, Sophomore, Aerospace Engineering, Pima Community College. Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College

[ASCEND-12] **Central Arizona College – NASA ASCEND!** Student: Karen Banda, Sophomore, Computer Science, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **CAC Beta X**. Student: Sonja Elstad, Sophomore, Electrical Engineering, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **Central Arizona College - NASA ASCEND**. Student: Cortney Fisher, Sophomore, Electrical Engineering, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **Central Arizona College – NASA ASCEND!** Student: James La Faut, Sophomore, Electrical Engineering, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **CAC Beta X**. Student: Elizabeth Maziarka, First-Year, Engineering Pathway, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **CAC Beta X**. Student: Jose Mendoza, First-Year, Software Development, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **CAC Beta X**. Student: Elijah Mountz, High School Student, Software Programming, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **Central Arizona College – NASA ASCEND!** Student: Norma Owens, Sophomore, Agricultural Business, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **Central Arizona College – NASA ASCEND!** Student: Jose Rodriguez, Sophomore, Mechanical Engineering, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **CAC Beta X**. Student: Christopher Santos, Sophomore, Civil Engineering, Central Arizona College. Mentor: Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **CAC Beta X**. Student: Hannah Tunstall, Sophomore, Computer Engineering, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

[ASCEND-12] **Central Arizona College – NASA ASCEND**. Student: Zhilong Zhu, Sophomore, Electrical Engineering, Central Arizona College. Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College

Program Schedule by Session

Session A:
Astronomy and Space Physics

Moderators:
Yancy Shirley, University of Arizona
Tim Swindle, University of Arizona

[A-1] **Noise Reduction in Low Frequency LIGO Detectors**. Student: Brandon Pillon, Junior, Space Physics, Embry-Riddle Aeronautical University. Mentor: Michelle Zanolin, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-1] **Noise Reduction in Low Frequency LIGO Detectors**. Student: Charles Wszalek, Junior, Space Physics, Embry-Riddle Aeronautical University. Mentor: Michele Zanolin, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-2] **Star Formation History of NGC 3344**. Student: Naomi Carl, Junior, Astrophysics, Physics, Arizona State University. Mentor: Sanchayeeta Borthakur, School of Earth and Space Exploration, Arizona State University

[A-3] **Dark Matter Models and Their Impact on Stellar Stream Morphology**. Student: Jack Kohm, Junior, Physics, Astrophysics, Northern Arizona University. Mentor: Lisa Chien, Astronomy and Planetary Sciences, Northern Arizona University

[A-4] **Distributional Methods for Detecting Supernova Gravitational Waves**. Student: Kya Schluterman, Junior, Space Physics, Embry-Riddle Aeronautical University. Mentor: Michele Zanolin, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-5] **Ultra Compact X-ray Binary Systems**. Student: Xander McLendon, Senior, Mechanical Engineering, Embry-Riddle Aeronautical University. Mentor: Pragati Pradhan, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-5] **Mass Transfer Analysis of Ultracompact X-ray Binary Systems**. Student: Clyde Miller, Junior, Mechanical Engineering (Propulsion), Embry-Riddle Aeronautical University. Mentor: Pragati Pradhan, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-6] **Examining the Stellar Population of NGC 3344**. Student: Eyan Weissbluth, Sophomore, Astrophysics, Arizona State University. Mentor: Sanchayeeta Borthakur, School of Earth and Space Exploration, Arizona State University

[A-7] **Analyzing Standing Accretion Shock Instability using Gravitational Wavescanva**. Student: Miriam Biehle, First-Year, Space Physics, Embry-Riddle Aeronautical University. Mentor: Michele Zanolin, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-8] **Galaxy Morphology of PEARLSDG**. Student: Noah McLeod, Junior, Astrophysics, Arizona State University. Mentor: Timothy Carleton, School of Earth and Space Exploration, Arizona State University

[A-9] **Analyzing the Variability and Orbit of Massive Binary Eta Carinae**. Student: Taylor Brown, Junior, Space Physics, Embry-Riddle Aeronautical University. Mentor: Noel Richardson, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-9] **Analyzing the Variability and Orbit of Massive Binary Eta Carinae**. Student: Shannon Moore, Junior, Space Physics, Embry-Riddle Aeronautical University. Mentor: Noel Richardson, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-10] **An Investigation of the Motion of Young Stellar Objects in NGC 1977, with a Focus on Externally Photoevporating Planet Forming Disks**. Student: Taylor Kalish, Junior, Physics, Mathematics, University of Arizona. Mentor: J. Serena Kim, Astronomy, University of Arizona

[A-11] **Dust Continuum Analysis of Distant Galaxies through Simulations of ALMA Observations**. Student: Sebastian Montano, Senior, Astrophysics, Arizona State University. Mentor: Allison Noble, School of Earth and Space Exploration, Arizona State University

[A-12] **Unveiling the Secrets of Neutron Stars; X-ray Astronomy with Spectro-timing Analysis**. Student: Derrick Drango, Sophomore, Mechanical Engineering, Embry-Riddle Aeronautical University. Mentor: Pragati Pradhan, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-13] **Fitting Density Profiles of Dynamical Dark Matter Halos**. Student: Tristen Shields, Sophomore, Physics, Astronomy, University of Arizona. Mentor: Eduardo Rozo, Physics, University of Arizona

[A-14] **Analyzing Dust in Distant Galaxies**. Student: Sarah Saavedra, Sophomore, Earth and Space Exploration (Astrophysics), Arizona State University. Mentor: Allison Noble, School of Earth and Space Exploration, Arizona State University

[A-15] **A Formaldehyde Deuteration Survey of Dense Starless Cores in Taurus**. Student: Hanga Andras-Letanovszky, Junior, Astronomy, Physics, Mathematics, University of Arizona. Mentor: Yancy Shirley, Astronomy and Steward Observatory, University of Arizona

[A-16] **Calibrating the ATLAS Calorimeter using Single Particle Interactions with Machine Learning**. Student: David Polk, Senior, Electrical and Computer Engineering, University of Arizona. Mentor: Kenneth Johns, Physics, University of Arizona

[A-17] **Digital Analysis of Ionospheric Plasma On-board Waves, Instabilities & Noise Spectrometer (WINS)**. Student: Ahmad Qureshi, Sophomore, Electrical and Computer Engineering, University of Arizona. Mentor: Naomi Yescas, Lunar and Planetary Laboratory, University of Arizona

[A-18] **Analyzing Archival FIMS/SPEAR Data to Construct a Far-Ultraviolet Background Map**. Student: Colton Quirk, Junior, Physics, Astronomy, University of Arizona. Mentor: Haeun Chung, Astronomy and Steward Observatory, University of Arizona

[A-19] **A Comparative Deuteration Survey of Starless Cores**. Student: Hannah Gruber, Sophomore, Astronomy, Physics, University of Arizona. Mentor: Yancy Shirley, Astronomy and Steward Observatory, University of Arizona

[A-20] **Measuring the Atmosphere of the Hot Jupiter WASP-43b with Gemini-S/IGRINS**. Student: Dare Bartelt, Senior, Astronomy, University of Arizona. Mentor: Megan Weiner Mansfield, Steward Observatory, University of Arizona

[A-21] **PEARLS: Discovery of Intermediate Redshift Seyfert-like Galaxies with Unique PSF-Features in their Cores Throughout the North Ecliptic Pole Time Domain Field**. Student: Rafael

Ortiz, Senior, Astrophysics, Arizona State University. Mentor: Rogier Windhorst, School of Earth and Space Exploration, Arizona State University

[A-22] **Searching for Red Rings from Weak AGN with JWST NIRCam**. Student: Jake Summers, Junior, Astrophysics, Physics, Mathematics, Arizona State University. Mentor: Rogier Windhorst, School of Earth and Space Exploration, Arizona State University

[A-23] **A Survey of Singly-Deuterated Ammonia in Prestellar Cores in the Taurus Molecular Cloud**. Student: Aurora Wilde, Sophomore, Physics, Astronomy, University of Arizona. Mentor: Yancy Shirley, Astronomy and Steward Observatory, University of Arizona

[A-24] **Be Stars: Lambda Pavonis**. Student: Sola Nova, Sophomore, Astronomy, Embry-Riddle Aeronautical University. Mentor: Noel Richardson, Physics and Astronomy, Embry-Riddle Aeronautical University

[A-25] **Photometric and Astrometric Properties of Ultracool Subdwarfs**. Student: Hunter Brooks, Junior, Astrophysics, Northern Arizona University. Mentor: Jasmine Garani, Astronomy and Planetary Science, Northern Arizona University

[A-26] **Utilizing Citizen Science to Identify Diffuse Galaxies**. Student: Nicolas Mazziotti, Junior, Astronomy, Physics, University of Arizona. Mentor: David Sand, Astronomy, University of Arizona

[A-In Title Only] **A Fast, Physically Motivated Halo Finding Algorithm**. Student: John Lucas Hugon, Sophomore, Physics, University of Arizona. Mentor: Eduardo Rozo, Physics, University of Arizona

Program Schedule by Session

Session B:
Earth and Environmental Science and Engineering

Moderators:
Christopher Edwards, Northern Arizona University
Chandra Holifield Collins, USDA-ARS Southwest Watershed Research Center

[B-1] **The Relationship Between Biological Soil Crust, Extracellular Polymeric Substances, and Soil Erosion on Varying Substrates to Investigate Biosignatures on Mars**. Student: Embrey Saville, Junior, Chemistry, Northern Arizona University. Mentor: Anita Antoninka, School of Forestry, Northern Arizona University

[B-2] **Airborne and Aquatic Micro-Nano Plastic Detection by Machine-Learning-Assisted Multispectral Imaging and Micro-Channel Flow Assays**. Student: Liam Falk, Junior, Applied Physics, University of Arizona. Mentor: Jeong-Yeol Yoon, Biomedical and Biosystems Engineering, University of Arizona

[B-3] **Groundwater Monitoring Assessment at the Falls City, Texas Uranium Tailings Disposal Site**. Student: Elyssa Baker, Junior, Environmental Science, Policy, Interamerican University of Puerto Rico - Ponce. Mentor: Angelita Denny, Department of Energy, Office of Legacy Management

[B-4] **Intermittent and Continuous Operation of an Off-Grid Solar Nanofiltration System**. Student: Abigail Haan, Junior, Chemical Engineering, University of Arizona. Mentor: Vasiliki Karanikola, Environmental Engineering, University of Arizona

[B-5] **Wildfires Working to Release and Remobilize Contaminants in Rural Arizona**. Student: Cameron Fuse, Sophomore, Environmental Engineering, University of Arizona. Mentor: Mónica Ramírez-Andreotta, Environmental Science, University of Arizona

[B-6] **Vegetation Monitoring at LM Sites**. Student: Alexis-Marie Parrish, Junior, Environmental Science, Alabama Agricultural and Mechanical University. Mentor: David Holbrook, Department of Energy, Office of Legacy Management

[B-7] **Tamarisk and Mycorrhizal Fungal Associations in Salix exigua**. Gabriella Garza, Junior, Biomedical Sciences, Northern Arizona University. Mentor: Catherine Gehring, Center of Adaptable Western Landscapes, Northern Arizona University

[B-8] **Ice Cloud Parameterizations for the Global Climate Models**. Student: Victoria Lang, Senior, Applied Meteorology, Embry-Riddle Aeronautical University. Mentor: Dorothea Ivanova, Applied Aviation Sciences, Embry-Riddle Aeronautical University

[B-9] **Cell Size and Temperature**. Student: Hayden Ferrell, Sophomore, Astrobiology and Biogeosciences, Biophysics, Arizona State University. Mentor: Elizabeth Trembath-Reichert, School of Earth and Space Exploration, Arizona State University

[B-10] **Earthworks and Ecosystems: A Web-Based Tool for Vegetation Monitoring in the Altar Valley**. Student: John Esparza, Junior, Biosystems Engineering, University of Arizona. Mentor: Mary Nichols, USDA-ARS Southwest Watershed Research Center

[B-11] **Inducing Pressure on Space Perovskite Solar Cells**. Student: Erin Burgard, Senior, Environmental Engineering, Arizona State University. Mentor: Nicholas Rolston, School of Electrical, Computer and Energy Engineering, Arizona State University

[B-12] **Sedimentary Analysis of Eklutna Lake, Alaska, to Understand Glacier Fluctuations Over the Past 9,600 Years**. Student: Tatum Hardt, Senior, Environmental Science, Northern Arizona University. Mentor: Darrell Kaufman, School of Earth and Sustainability, Northern Arizona University

[B-13] **Protein Domains with Unbalanced Amino Acid Usage are Differentially Lost**. Student: Garret Wilson, Senior, Molecular and Cellular Biology, Computer Science, University of Arizona. Mentor: Sawsan Wehbi, Ecology and Evolutionary Biology, University of Arizona

[B-14] **Remote Sensing for Yellowstone Geothermal Area Characterization**. Student: Jessica Condon, Senior, Geology, Modern Languanges, Northern Arizona University. Mentor: Greg Vaughan, Astrogeology, US Geological Survey

[B-15] **Analysis of Extraterrestrial Radiation's Impact on Ozone and its Implications for Climate and Health on a High-Altitude Ballooning Payload**. Students: ASU ASCEND Team, Arizona State University. Mentor: Tom Sharp, School of Earth and Space Exploration, Arizona State University

[B-16] **Manufacturable & Robust Perovskite Solar Devices for Space**. Student: Kayshavi Bakshi, Senior, Mechanical Engineering, Arizona State University. Mentor: Nicholas Rolston, School of Electrical, Computer, and Energy Engineering, Arizona State University

[B-17] **Dielectrophoretic Characterization of Micron-Sized Mineral Particles**. Student: Ethan Johnson, Senior, Chemistry, Arizona State University. Mentor: Hilairy Hartnett, School of Earth and Space Exploration, Arizona State University

[B-18] **A Tale of Two Trace Metals: A Yellowstone Mystery**. Student: Simon Fronmueller, Junior, Astrobiology, Biogeosciences, Arizona State University. Mentor: Everett Shock, School of Earth and Space Exploration, Arizona State University

[B-In Title Only] **Leveraging GIS Technology for Wildfire Response Analysis in Maui**. Student: Elizabeth Garayzar, Junior, Technological Leadership, Geographic Information Science, Arizona State University. Mentor: Eric Stribling, Interplanetary Initiative, Arizona State University

Program Schedule by Session

Session C:
Aeronautics

Moderators:
Elliott Bryner, Embry-Riddle Aeronautical University
Thomas Sharp, Arizona State University

[C-1] **Design of Actuated Systems for Flying Machines**. Student: Ryan Oppen, Junior, Aerospace Engineering, Arizona State University. Mentor: Timothy Takahashi, School for Engineering of Matter, Transport, and Energy, Arizona State University

[C-2] **Characterization of the Effects of Sweep at Low Reynolds Number**. Student: Kylee Bennett, Senior, Aerospace Engineering, Embry-Riddle Aeronautical University. Mentor: Traub Lance, Aerospace Engineering, Embry-Riddle Aeronautical University

[C-2] **Characterization of the Effects of Sweep at Low Reynolds Number**. Student: Davy Stanfield Brown, Senior, Aerospace Engineering, Embry-Riddle Aeronautical University. Mentor: Lance Traub, Aerospace Engineering, Embry-Riddle Aeronautical University

[C-3] **Flow Temperature Characterization of a Mach 5 Wind Tunnel**. Student: Veer Nayyar, Junior, Mechanical Engineering, University of Arizona. Mentors: Alex Craig and Brian Kinsey, Aerospace and Mechanical Engineering, University of Arizona

[C-4] **Aerospace Alloy Advancements**. Student: Lina Youssfi, Sophomore, Aerospace Engineering, Arizona State University. Mentor: Timothy Takahashi, School of Engineering, Matter, Transport and Energy, Arizona State University

[C-5] **Autonomous High-Altitude Balloon Payload**. Student: Anyell Mata, Senior, Electrical Engineering, Arizona State University. Mentor: Jnaneshwar Das, School of Earth and Space Exploration, Arizona State University

[C-In Title Only] **Stochastic sUAS Aircraft Performance Prediction**. Student: Lucas Guaglardi, Senior, Aerospace Engineering, Arizona State University. Mentor: Timothy Takahashi, School for Engineering of Matter, Transport and Energy, Arizona State University

Program Schedule by Session

Session D:
Planetary Science

Moderators:
Thomas Sharp, Arizona State University
Sarah Sutton, University of Arizona

[D-1] **Mapping Mounds in Utopia Planitia to Investigate the Origins of Martian Volcanic Features**. Student: Greta Freeman, Junior, Geology, Northern Arizona University. Mentor: Chris Okubo, USGS Astrogeology Science Center

[D-2] **Mapping Martian Crustal Magnetic Anomalies**. Student: Travis Matlock, Senior, Astronomy, University of Arizona. Mentor: Lon Hood, Lunar and Planetary Laboratory, University of Arizona

[D-3] **Post-Mid-Size Asteroid Impact Long-term Flooding Hazards**. Student: Lucienne Morton, Sophomore, Geology, Northern Arizona University. Mentor: Timothy Titus, USGS Astrogeology Science Center, US Geological Survey

[D-4] **Analysis of Dust Produced by Experimental Aeolian Transport of Mars-Analog Sands**. Student: Rachel Fry, Senior, Physics, Astrophysics, Northern Arizona University. Mentor: Devon Burr, Astronomy and Planetary Science, Northern Arizona University

[D-5] **Atmospheric Revelations: Probing Exoplanets Composition and Structure Through Innovative Instrumentation**. Student: Conor Earley, Senior, Astrophysics, Arizona State University. Mentor: Nathaniel Butler, School of Earth and Space Exploration, Arizona State University

[D-6] **Mapping Enigmatic Pits in the North Polar Layered Deposits of Mars**. Student: Dora Elalaoui-Pinedo, Sophomore, Planetary Geoscience, University of Arizona. Mentor: Sarah Sutton, Lunar and Planetary Laboratory, University of Arizona

[D-7] **Exploring the Martian Agriculture Frontier: Assessing Tomato Adaptability Through High Altitude Experimentation**. Students: CGUHS ASCEND Team, Casa Grande Union High School. Mentor: John Morris, Career and Technical Education, Casa Grande Union High School

[D-8] **Building Computational Models to Understand The Interplay Between Climatic Factors, Air, Transportation, and Infectious Disease Dynamic**. Student: Olivia Vester, Junior, Computer Science, Northern Arizona University. Mentor: Kayode Oshinubi, School of Informatics, Computing, and Cyber Systems, Northern Arizona University

[D-9] **Photosynthetic Potential on TRAPPIST-1e: Modeling for Exoplanetary Life**. Student: Cameron Hrabak, Senior, Biomedical Sciences, Northern Arizona University. Mentors: Christopher Doughty and Michael Gowanlock, School of Informatics, Computing, and Cyber Systems, Northern Arizona University

[D-10] **Space Weathering of Dark Regolith and Carbonaceous Asteroids**. Student: Emily Clark, Junior, Physics, Astrophysics, Northern Arizona University. Mentor: Mark Loeffler, Astronomy and Planetary Science, Northern Arizona University

[D-11] **Optimization of Lunar Map Distortion**. Student: Jessica Maldonado, Junior, Software Engineering, Northern Arizona University. Mentor: Mark McClernan, US Geological Survey

[D-12] **Investigating the Cause of Mars' Large Volcanoes from Deep Mantle Convection**. Student: Ritisha Das, Senior, Mechanical Engineering, Mathematics, Arizona State University. Mentor: Mingming Li, School of Earth and Space Exploration, Arizona State University

Program Schedule by Session

Session E:
Exploration Systems Engineering: Biological, Materials, Optical, and Electrical

Moderators:
Jonathan Adams, Embry-Riddle Aeronautical University
Michele Zanolin, Embry-Riddle Aeronautical University

[E-1] **Investigation of Stress Concentrations in Fused Deposition Modeled Parts**. Student: Nathan Bleakley, Junior, Mechanical Engineering, Embry-Riddle Aeronautical University. Mentor: David Lanning, Aerospace Engineering, Embry-Riddle Aeronautical University

[E-1] **Investigation of Stress Concentrations in Fused Deposition Modeled Parts**. Student: Winona Roulston, Senior, Mechanical Engineering, Embry-Riddle Aeronautical University. Mentor: David Lanning, Aerospace Engineering, Embry-Riddle Aeronautical University

[E-2] **NASA Surveyor Program: Surveyors 1, 3, 5, 6, and 7**. Student: Chad Cantin, Junior, Aerospace Engineering, University of Arizona. Mentor: Shane Byrne, Lunar and Planetary Laboratory, University of Arizona

[E-3] **Transparent Conductive Oxides for Quantum Optical Devices: A Computational Approach**. Student: Henry Garland, Sophomore, Chemistry, Northern Arizona University. Mentor: Stephanie Hurst, Chemistry and Biochemistry, Northern Arizona University

[E-4] **Comparison of In-process Distortion for Metal Additive Manufacturing Processes Using Simulations**. Student: Juan Machado Jr., Sophomore, Mechanical Engineering, University of Arizona. Mentor: Hannah Budinoff, Systems and Industrial Engineering, University of Arizona

[E-5] **Optimization of Inverse Kinematics with Deep Learning**. Student: Mitchell Todd, Sophomore, Mechanical Engineering (Computational Mechanics), Arizona State University. Mentor: Anoop Grewal, Engineering Academic and Student Affairs, Arizona State University

[E-6] **Smart Sandbag for Autonomous Lunar Construction**. Student: Michael Villasana, Senior, Electrical and Computer Engineering, University of Arizona. Mentor: Jekan Thanga, Aerospace and Mechanical Engineering, University of Arizona

[E-7] **Iron Meteorite Imaging and Database**. Student: Samantha Beauchaine, Junior, Geological Sciences, Arizona State University. Mentor: Cassie Bowman, School of Earth and Space Exploration, Arizona State University

[E-8] **Implantable Bone Sensors to Monitor Fracture Healing**. Student: Leonel Almanzar, Sophomore, Chemical Engineering, University of Arizona. Mentor: David Margolis, Orthopedic Surgery, University of Arizona

[E-9] **Thin Films For Use in Quantum Networking: Effect of P-type Doping on Spin Coated ITO Thin Films**. Student: Selena Lamborn, Senior, Chemistry, ACS Comprehensive, Northern Arizona University. Mentor: Stephanie Hurst, Chemistry and Biochemistry, Northern Arizona University

[E-10] **Bathymetric LiDAR: Investigation of Optimal Visible Light for Non-Ideal Aquatic Environments**. Student: Breck Meagher, Senior, Space Physics, Embry-Riddle Aeronautical University.

Mentor: John Pavlina, Electrical, Computer, and Software Engineering Department, Embry-Riddle Aeronautical University

[E-10] **Bathymetric LiDAR: Investigation of Optimal Visible Light for Non-Ideal Aquatic Environments**. Student: Zachary Traynor, Senior, Electrical Engineering, Embry-Riddle Aeronautical University. Mentor: John Pavlina, Electrical, Computer, & Software Engineering Department, Embry-Riddle Aeronautical University

[E-11] **Waves, Instabilities, & Noise Spectrometer (WINS) for Earth's Ionosphere**. Student: Sarina Blanchard, Junior, Mechanical Engineering, University of Arizona. Mentor: Naomi Yescas, Lunar and Planetary Laboratory, University of Arizona

[E-12] **Development of Machine Learning Assisted Surrogate Models for Complex Space Structures**. Student: Grace Morris, Senior, Mechanical Engineering, Northern Arizona University. Mentor: Subhayan De, Mechanical Engineering, Northern Arizona University

[E-13] **FPGA-based RADAR Signal Processing**. Student: Saket Shanbhag, Junior, Electrical Engineering, Arizona State University. Mentor: Tracee Jamison-Hooks, School of Earth and Space Exploration, Arizona State University

Program Schedule by Session

Session F:
Education and Public Outreach

Moderators:
Anne Boettcher, Embry-Riddle Aeronautical University
Paloma Rose Davidson, Northern Arizona University

[F-1] **Project Management Practices for Undergraduate Space Projects**. Student: Calvin Henggeler, Senior, Computer Engineering, Embry-Riddle Aeronautical University. Mentor: Ahmed Sulyman, Department of Computer, Electrical, and Software Engineering, Embry-Riddle Aeronautical University

[F-1] **Project Management Practices for Undergraduate Space Projects**. Student: Logan Ruddick, Senior, Aerospace Engineering, Astronautics, Embry-Riddle Aeronautical University. Mentor: Ahmed Sulyman, Department of Computer, Electrical, and Software Engineering, Embry-Riddle Aeronautical University

[F-2] **Exploration of ChatGPT as a Research Tool for Exoplanet Detection and Analysis**. Student: Matthew Marquez, Senior, Technological Leadership, Arizona State University. Mentor: Lance Ghavari, Herberger Institute For Design and the Arts, Arizona State University

[F-3] **The Science of Storytelling: Science Journalism at the Arizona Daily Sun**. Student: Madison Marie Easton, Senior, Biological Sciences, Spanish, Northern Arizona University. Mentor: Chris Etling, Arizona Daily Sun

[F-4] **Scientific Writing at UArizona's University Communications**. Student: Penny Duran, Sophomore, Physics, University of Arizona. Mentor: Daniel Stolte, University Communications, University of Arizona

[F-5] **Space For Humans**. Student: Lindsey Tober, Junior, Technological Leadership, Arizona State University. Mentor: Eric Stribling, Interplanetary Initiative, Arizona State University

[F-6] **Bridges to Belonging**. Student: Katrina Robertson, Senior, Mechanical Engineering, Embry-Riddle Aeronautical University. Mentor: Johnathan Adams, Humanities and Communications, Embry-Riddle Aeronautical University

[F-7] **Digitizing Eugene Shoemaker's Legacy**. Student: Virginia Crook, Junior, Physics, Astrophysics, Northern Arizona University. Mentor: Marc Hunter, USGS Astrogeology Science Center, Northern Arizona University

[F-8] **Making Meteorites Accessible**. Student: Sam Campbell, Junior, Astrobiology, Arizona State University. Mentor: Rhonda Stroud, Buseck Center for Meteorite Studies, Arizona State University

[F-9] **Mars in 3D: Creating Accessible Planetary Science Education**. Student: Alexandra Kupersmith, Junior, Physics, Astronomy, University of Arizona. Mentor: Steve Kortenkamp, Lunar and Planetary Laboratory, University of Arizona

[F-10] **Developing NAU's First Undergraduate Science Communication Course**. Student: Kayla Blair, Senior, Physics, Astrophysics, Northern Arizona University. Mentor: Lisa Chien, Astronomy and Planetary Sciences, Northern Arizona University

Session G:
Aerospace Technology: Spaceflight and Engineering Programs

Moderators:
Anne Boettcher, Embry-Riddle Aeronautical University
Elliott Bryner, Embry-Riddle Aeronautical University
Ron Madler, Embry-Riddle Aeronautical University

[G-1] **Continuously Integrated Raster Scan Algorithm for Microwave Antenna Holography**. Student: Chance Lawrence, Senior, Astronomy, Statistics and Data Science, University of Arizona. Mentor: Mike Parker, Rincon Research Corporation

[G-2] **CatSat: Ground Station Assembly & Mission Operations**. Student: Sarah Li, Senior, Systems Engineering, University of Arizona. Mentor: Christopher Walker, Astronomy and Steward Observatory, University of Arizona

[G-3] **CatSat: Preparing for CubeSat Flight Operations and Science**. Student: Walter Rahmer, Senior, Optical Sciences and Engineering, University of Arizona. Mentor: Christopher Walker, Astronomy and Steward Observatory, University of Arizona

[G-4] **Exploratory Study on Wind Tunnel Noise Profiles**. Student: Sam Bevier, Senior, Aerospace Engineering, University of Arizona. Mentor: James Threadgill, Aerospace and Mechanical Engineering, University of Arizona

[G-5] **Embedded Software Development on the EagleSat 2 Memory Degradation Experiment**. Student: Nikhil Dave, Junior, Computer Engineering, Embry-Riddle Aeronautical University. Mentor: Ahmed Sulyman, Department of Computer, Electrical, and Software Engineering, Embry-Riddle Aeronautical University

[G-5] **Embedded Software Development for the EagleSat 2 Memory Degradation Experiment**. Student: Tyler Thurman, Senior, Computer Engineering, Embry-Riddle Aeronautical University. Mentor: Ahmed Sulyman, Computer, Software, and Electrical Engineering Department, Embry-Riddle Aeronautical University

[G-6] **Satellite Research**. Student: James Felder, High School Student, Raymond S. Kellis. Mentor: William Chernoff, Sociology and Criminal Justice, Southeastern Louisiana University

[G-7] **3-D Printed Afterglow Filters for Air Pollution Control**. Student: Gabriel Negrao, Senior, Chemical Engineering, Arizona State University. Mentor: Jean Andino, School for Engineering of Matter, Transport and Energy, Arizona State University

[G-8] **Pneumatic System Integration in Supersonic Flow**. Student: Rachel Rhomberg, Junior, Aerospace Engineering, University of Arizona. Mentor: James Threadgill, Aerospace and Mechanical Engineering, University of Arizona

[G-9] **Trajectory Optimization for Shuttle Via Earth-Mars Cycler Orbit**. Student: Kyle Newlin, Senior, Aerospace Engineering, Embry-Riddle Aeronautical University. Mentor: Davide Conte, Aerospace Engineering, Embry-Riddle Aeronautical University

[G-10] **Deployable Optical Receiver Aperture (DORA)**. Student: Genevieve Cooper, Senior, Computer Science, Arizona State University. Mentor: Danny Jacobs, Interplanetary Laboratories, Arizona State University

[G-11] **Aspera Space Mission Science Targets and Analysis**. Student: Alondra Cardona, Junior, Astronomy, University of Arizona. Mentor: Carlos Vargas, Astronomy and Steward Observatory, University of Arizona

2023-2024 Arizona NASA Space Grant Student Abstracts

Organized by presenter's last name.

Adair, Berkeley (Junior, Aerospace Engineering, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [ASCEND-4]

ANALYSIS OF EXTRATERRESTRIAL RADIATION'S IMPACT ON OZONE AND ITS IMPLICATIONS FOR CLIMATE AND HEALTH ON A HIGH-ALTITUDE BALLOONING PAYLOAD

In Fall 2023, the purpose of the ASCEND flight was to complete a Meteorology science mission. The meteorological mission used pressure, internal and external temperature, GPS, and accelerometer to monitor barometric pressure in relation to the storm system passing through Arizona during that launch. In Spring 2024, ASCEND used a UV sensor and Geiger-Müller tube to explore the link between solar wind radiation, UVB radiation, and ozone layer dynamics. Post-flight, correlations between radiation levels and ozone layer effects were analyzed in order to determine extraterrestrial radiation's impact on ozone and its implications for climate and health. Overall, ASCEND created a reusable design for the printed circuit board (PCB) and designed an advanced payload capable of withstanding a flight in the atmosphere and impact landing, while keeping its contacts intact.

Adamu, Razak (Sophomore, Aerospace Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [NEBP-5]

ARIZONA SOUTH NEBP TEAM

The AZ South team comprises ASU, UA, and CGUHS. Our main goal is to collect and analyze high-altitude data between 70,000 to 85,000 feet during the 2023 Annular Solar Eclipse in Roswell, NM, and the 2024 Total Solar Eclipse in Uvalde, TX. Two types of data are useful to study and understand the phenomena of the moon's shadow passing the Sun: changes in the pressure, temperature, density, and wind speed against the altitudes and atmosphere's layers and live video recording of the totality and the Sun's Corona. The UA team prioritized mechanical design for the payloads, engineering suitable housings for the RFD-900 (GPS transponder) and PTERODACTYL (atmospheric data collector) while considering space, weight, and durability constraints. Verification and validation were carried out to examine the robustness of 3D filament, as well as confirm code and payload function.

Akert, Timothy (Sophomore, Mechanical Engineering, Pima Community College). Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College. [ASCEND-11]

EXTRATERRESTRIAL SOLAR POWER AND HYDRO CRYSTALLINE STRUCTURES

Atmospheric research plays a key role in understanding the environment. Technologies including solar panels, form the backbone of the future of clean energy on earth and understanding how to optimize their power output is critical. The study of water and its uses yields new applications for industry use including engineering and manufacturing. This research was conducted using a cubic satellite payload modeled after NASA's CubeSat design. The three separate chambers contain the electronics and power sources, the camera optics, digital logic circuits, and the water substance with a fixed optical magnification device. The payload was sent to the stratosphere to capture data on various aspects of the structure of water and factors affecting the power output of an array of solar panels including ambient light, temperature, altitude, and radiation. This research will aid in the optimization of solar panel operation and further understanding the behavior of water under different conditions.

Almanzar, Leonel (Sophomore, Chemical Engineering, University of Arizona). Mentor: David Margolis, Orthopedic Surgery, University of Arizona. [E-8]

IMPLANTABLE BONE SENSORS TO MONITOR FRACTURE HEALING

One of the biggest problems in space travel is the deterioration of astronauts' bones due to prolonged exposure to microgravity. Bones rely on regular loading to be strong. Minimizing the risk of fractures is critical to the health of the astronauts for long-duration missions in space. To continue to push the limits of space exploration, this research specializes in implantable wireless and battery free sensors (osseosurface electronics) to advance orthopedic healthcare. In this three year study, osseosurface electronics are used to monitor long-bone fracture healing in a sheep model. Our devices provide a real time measurement of local strain in the bone through the healing period of the fracture. With this information, we look to better monitor bone activity, which can be beneficial for future space explorations. The capability to accurately measure astronauts' bone strength holds promise for mitigating bone injuries during space missions.

Andras-Letanovszky, Hanga (Junior, Astronomy, Physics, Mathematics, University of Arizona). Mentor: Yancy Shirley, Astronomy and Steward Observatory, University of Arizona. [A-15]

A FORMALDEHYDE DEUTERATION SURVEY OF DENSE STARLESS CORES IN TAURUS

Starless cores are dense, cold clumps of gas and dust in molecular clouds that can collapse into a protostar. The initial conditions of the future planet-forming disk are set during the starless phase, so understanding starless core evolution is crucial for understanding star and planet formation. One probe of these conditions is deuteration, where deuterium replaces one or more of a molecule's hydrogen atoms. Molecular deuteration increases in cold, dense regions, so older cores typically have more deuterated molecules, although cores can evolve at different rates. This project surveys HDCO/oH2CO ratios in 11 starless cores in the Barnard 10 region of Taurus. HDCO was thought to deuterate on icy dust grain surfaces, like its more complex counterpart CH2DOH, but our observations indicate there may also be gas-phase contributions. We calculate the deuterium fraction of [HDCO/oH2CO] and compare it to the chemical and physical evolutionary properties of the cores.

Arcarese, Matthew (Junior, Electrical Engineering, Pima Community College). Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College. [ASCEND-11]

EXTRATERRESTRIAL SOLAR POWER AND HYDRO CRYSTALLINE STRUCTURES

Atmospheric research plays a key role in understanding the environment. Technologies including solar panels, form the backbone of the future of clean energy on earth and understanding how to optimize their power output is critical. The study of water and its uses yields new applications for industry use including engineering and manufacturing. This research was conducted using a cubic satellite payload modeled after NASA's CubeSat design. The three separate chambers contain the electronics and power sources, the camera optics, digital logic circuits, and the water substance with a fixed optical magnification device. The payload was sent to the stratosphere to capture data on various aspects of the structure of water and factors affecting the power output of an array of solar panels including ambient light, temperature, altitude, and radiation. This research will aid in the optimization of solar panel operation and further understanding the behavior of water under different conditions.

ASU ASCEND (Arizona State University). Mentor: Tom Sharp, School of Earth and Space Exploration, Arizona State University. [B-15]

ANALYSIS OF EXTRATERRESTRIAL RADIATION'S IMPACT ON OZONE AND ITS IMPLICATIONS FOR CLIMATE AND HEALTH ON A HIGH-ALTITUDE BALLOONING PAYLOAD

In Fall 2023, the purpose of the ASCEND flight was to complete a Meteorology science mission. The meteorological mission used pressure, internal and external temperature, GPS, and accelerometer to monitor barometric pressure in relation to the storm system passing through Arizona during that launch. In Spring 2024, ASCEND used a UV sensor and Geiger-Müller tube to explore the link between solar wind radiation, UVB radiation, and ozone layer dynamics. Post-flight, correlations between radiation levels and ozone layer effects were analyzed in order to determine extraterrestrial radiation's impact on ozone and its implications for climate and health. Overall, ASCEND created a reusable design for the printed circuit board (PCB) and designed an advanced payload capable of withstanding a flight in the atmosphere and impact landing, while keeping its contacts intact.

Baker, Elyssa (Junior, Environmental Science, Policy, Interamerican University of Puerto Rico - Ponce). Mentor: Angelita Denny, Department of Energy, Office of Legacy Management. [B-3]

GROUNDWATER MONITORING ASSESSMENT AT THE FALLS CITY, TEXAS URANIUM TAILINGS DISPOSAL SITE

LM seeks to discontinue or reduce best management practice groundwater monitoring at the Falls City Disposal Site in Texas. This study aimed to assess the necessity of the current monitoring program and develop an appropriate action plan for the uranium mill tailings disposal site. Groundwater was not remediated at the site due to elevated background concentrations of uranium, and compliance monitoring is not required at the site due to a limited use designation. Tailings-impacted groundwater has been and continues to be under private property. The study assessment involved studying the impact of legacy contamination on groundwater quality downgradient and ensuring beneficial uses such as livestock watering are protected, as outlined in the 2008 Falls City Long-Term Surveillance Plan. Current concerns center around the plume having surpassed the current monitoring network, prompting an expansion of the area for issuance of letters to private landowners advising against the use of groundwater from impacted aquifers.

Bakshi, Kayshavi (Senior, Mechanical Engineering, Arizona State University). Mentor: Nicholas Rolston, School of Electrical, Computer, and Energy Engineering, Arizona State University. [B-16]

MANUFACTURABLE & ROBUST PEROVSKITE SOLAR DEVICES FOR SPACE

Perovskite films are the future of solar cell technology as they are not only low cost to produce but also have a high conversion efficiency (26%+), making them very promising for satellite power generation. Fortunately, the absence of moisture and oxygen in space makes Perovskites more suitable for space applications, potentially enabling their long-term durability. Nevertheless, there is limited understanding of the durability of perovskite solar arrays in space. This project looks to determine the mechanical and material properties of these perovskite materials in order to better understand their future capabilities. Furthermore, this study offers strategies to improve the fracture energy of these films by adding polymers and food-additive starches to the recipe. Aided by the use of Glow Discharge Optical Emission Spectroscopy and X-ray diffraction, we also study the compositional and structural changes caused by the corn starch polymers to elucidate the mechanism behind the improved fracture toughness.

Banda, Karen (Sophomore, Computer Science, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CENTRAL ARIZONA COLLEGE – NASA ASCEND!

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named “Cuisine” is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Banks, Courtney (Senior, Computer Science, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [NEBP-5]

ARIZONA NATIONWIDE ECLIPSE BALLOONING PROJECT

This project, as part of the Arizona South team for the Nationwide Eclipse Ballooning Project (NEBP), aims to implement a live video streaming system for high-altitude balloon payloads during both the 2023 and the 2024 eclipses. The system utilizes a Raspberry Pi for video capture from two 190-degree cameras, providing a panoramic view of the surrounding atmosphere and the Earth below. The goal is capturing the eclipse itself and the umbra’s path on the ground. To enhance data analysis, a GPS module is integrated with the Pi for precise time keeping, enabling later synchronization of video footage with other payload data. Data transmission to a ground station for live YouTube broadcast is achieved through a pair of Ubiquiti radios. To optimize transmission quality, a Ubiquiti WiFiMan spectrum analyzer was employed to determine the best frequencies for the flight. Distance tests were also conducted to improve signal strength and quality.

Bartelt, Dare (Senior, Astronomy, University of Arizona). Mentor: Megan Weiner Mansfield, Steward Observatory, University of Arizona. [A-20]

MEASURING THE ATMOSPHERE OF THE HOT JUPITER WASP-43B WITH GEMINI-S/IGRINS

High-resolution spectroscopy allows for the measurement of precise abundances of several carbon- and oxygen-bearing molecules in exoplanet atmospheres. We observed four transits of the hot Jupiter WASP-43b between 1.45-2.45 μm with the high-resolution Immersion GRating INfrared Spectrometer (IGRINS) on the Gemini-South telescope. One transit was discarded due to significant humidity in the atmosphere. Principal Component Analysis was performed to remove tellurics, stellar signals, and instrument throughput to obtain the planet's signal. Cross-correlation was then performed to retrieve the molecular absorption features. We detect water in the atmosphere at a significance of 3.24σ. We obtain a lower limit of 1×10^{-4} on the water volume mixing ratio using a Markov Chain Monte Carlo retrieval. The water detection is consistent with previous low-resolution observations. Future research to constrain the abundance of water will allow for a greater understanding of the composition and formation of this planet.

Beauchaine, Samantha (Junior, Geological Sciences, Arizona State University). Mentor: Cassie Bowman, School of Earth and Space Exploration, Arizona State University. [E-7]

IRON METEORITE IMAGING AND DATABASE

The NASA Psyche mission, led by ASU's Dr. Lindy Elkins-Tanton, launched October 13, 2023. The orbiter mission's target is the Psyche asteroid, the only known place in our solar system where we can examine directly what may contain metal from the core of an early planetary building block. The overarching goal of this larger project is to determine the bulk chemical compositions of iron meteorites from their optical images (a computer algorithm developed by computer science capstone students would be able to identify the inclusions on its own after being trained on the images acquired) and compare this to data acquired remotely at Psyche.

Bennett, Kylee (Senior, Aerospace Engineering, Embry-Riddle Aeronautical University). Mentor: Traub Lance, Aerospace Engineering, Embry-Riddle Aeronautical University. [C-2]

CHARACTERIZATION OF THE EFFECTS OF SWEEP AT LOW REYNOLDS NUMBER

The project is an investigation of wing sweep at low Reynolds numbers. Sweep is the offset of the wing from the direction of flow. The research idea is founded on the growing popularity of small-scale drones. Unmanned aerial vehicles (UAVs) and micro air vehicles (MAVs) have seen an increase in use. Efficient design of UAVs and MAVs requires a better understanding of their associated aerodynamics. This need has contributed to an increase in research regarding various wing designs. For the project, the effects of wing sweep were examined. The wings, comprised of two airfoil profiles, were manufactured with leading edge angles from 0 to 45 degrees. Testing encompassed experimental load measurement at Reynolds number ranging from 40,000 - 80,000. The trends found were consistent for both airfoils. Sweep was observed to increase wing efficiency and performance as reflected in the maximum lift to drag ratio and maximum lift coefficient achieved.

Bevier, Sam (Senior, Aerospace Engineering, University of Arizona). Mentor: James Threadgill, Aerospace and Mechanical Engineering, University of Arizona. [G-4]

EXPLORATORY STUDY ON WIND TUNNEL NOISE PROFILES

This project seeks to compare the natural noise profiles of various wind tunnels using a precision-machined 5-degree cone with a sharp tip. Installation in each wind tunnel requires bespoke mounting hardware that has been designed and manufactured. Three supersonic wind tunnels at the University of Arizona are assessed, each with unique challenges, loading considerations, and form factors to be taken into account. Stress analysis was conducted during the design process to ensure survivability and effective operation. Along the cone, pressure transducers are installed to quantify pressure fluctuations in the flow, providing a characteristic "wind tunnel fingerprint" for each facility. These characteristics become vital when considering experimental results that may/may not be susceptible to a particular noise environment (such as laminar to turbulent transition). Overall, this research specifically targets developing characterization methodologies and enhancing experimental reliability.

Biehle, Miriam (First-Year, Space Physics, Embry-Riddle Aeronautical University). Mentor: Michele Zanolin, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-7]

ANALYZING STANDING ACCRETION SHOCK INSTABILITY USING GRAVITATIONAL WAVESCANVA

The detection of gravitational waves (GW) from Core Collapse Supernovae (CCSNe) would build a new understanding of the internal physics of a Core collapse Supernova (CCSN). One of the features of these GW is called standing accretion shock instability (SASI). In order to detect and reconstruct the SASI component of a CCSN GW, our team will be upgrading the current software. More explicitly by implementing MuLaSECc (Multi-Layer Signal Enhancement with Coherent Wave Burst and CNN [Convolutional Neural Network]) we can artificially decrease the role of the noise recorded by LIGO. By advancing this program further we can increase the potential of multi-messenger astrophysics since CCSNe can be studied with GW, electromagnetic waves, and neutrinos at the same time.

Blair, Kayla (Senior, Physics, Astrophysics, Northern Arizona University). Mentor: Lisa Chien, Astronomy and Planetary Sciences, Northern Arizona University. [F-10]

DEVELOPING NAU'S FIRST UNDERGRADUATE SCIENCE COMMUNICATION COURSE

Modern-day scientists are expected to be proficient in both fundamental knowledge and science communication. Additionally, communication is identified as a second most important career readiness competency by the National Association of Colleges and Employers, therefore undergraduate students are in need of opportunities to practice their communication skills. However, most STEM curricula in higher education emphasizes professional communication, with little or no training in public engagement and community outreach. Studies show that the earlier these science communication skills are practiced, the more prepared students are to utilize them in their daily lives. To help students at Northern Arizona University enhance these skills, and to provide community engagement opportunities, we developed and piloted NAU’s first undergraduate science communication course in Spring 2024, focusing on astronomy and planetary science. Here we present our curriculum development and our analysis of students’ approaches toward science communication.

Blanchard, Sarina (Junior, Mechanical Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [NEBP-5]

ARIZONA SOUTH NEBP TEAM

The AZ South team comprises ASU, UA, and CGUHS. Our main goal is to collect and analyze high-altitude data between 70,000 to 85,000 feet during the 2023 Annular Solar Eclipse in Roswell, NM, and the 2024 Total Solar Eclipse in Uvalde, TX. Two types of data are useful to study and understand the phenomena of the moon’s shadow passing the Sun: changes in the pressure, temperature, density, and wind speed against the altitudes and atmosphere’s layers and live video recording of the totality and the Sun’s Corona. The UA team prioritized mechanical design for the payloads, engineering suitable housings for the RFD-900 (GPS transponder) and PTERODACTYL (atmospheric data collector) while considering space, weight, and durability constraints. Verification and validation were carried out to examine the robustness of 3D filament, as well as confirm code and payload function.

Blanchard, Sarina (Junior, Mechanical Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

UARIZONA ASCEND: HIGH-ALTITUDE DATA COLLECTION WITH A CUSTOM CUBESAT PAYLOAD

CubeSats have been a rapidly growing technology over the last decade due to their diminutive total mass to orbit while maintaining spacecraft performance. However, due to their small form factor, CubeSats are extremely limited in the amount of electronics and power storage that they can carry. Within the bounds of a standard 1U CubeSat, the UArizona ASCEND payload houses an atmospheric profiling system to collect data up to 100,000 feet. The project incorporates low power considerations, volume optimization, and high durability 3D printing to improve on the University's previous ASCEND launches. The CubeSat uses durable PETG thermoplastic polyester to ensure the safety of the housing. In addition, two traditional small form factor cameras collect unique views of Earth's atmosphere throughout the ascent and descent of the payload.

Blanchard, Nicolas (Post-Baccalaureate, Electrical and Computer Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

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Blanchard, Sarina (Junior, Mechanical Engineering, University of Arizona). Mentor: Naomi Yescas, Lunar and Planetary Laboratory, University of Arizona. [E-11]

WAVES, INSTABILITIES, & NOISE SPECTROMETER (WINS) FOR EARTH'S IONOSPHERE

Earth's ionosphere, spanning from ten to a thousand kilometers above the Earth's surface, contains large amounts of charged particles. Our project seeks to further our understanding of ionosphere dynamics focusing on applying the technology of legacy instruments to map plasma conditions across three dimensions: longitude, latitude, and altitude. Within the bounds of a 1U CubeSat, the WINS payload will contain an analog-to-digital converter printed circuit board (PCB), an integrated circuit to process data, and an antenna system to transmit the data back to the Earth. The custom analog-to-digital converter (ADC) PCB utilizes a high-linearity, ultra-low power ADC to convert analog input signals to digital outputs while considering space, voltage, and power constraints. Testing and further development will be carried out from the first iteration to improve the design and provide more accurate results.

Bleakley, Nathan (Junior, Mechanical Engineering, Embry-Riddle Aeronautical University). Mentor: David Lanning, Aerospace Engineering, Embry-Riddle Aeronautical University. [E-1]

INVESTIGATION OF STRESS CONCENTRATIONS IN FUSED DEPOSITION MODELED PARTS

Fused Deposition Modeling (FDM), an additive manufacturing process, has an increasing presence within industry. However, there is a lack in knowledge about process parameters that affect the quality and mechanical properties of FDM parts. To investigate these effects, the infill is constrained to a 'gyroid' pattern, and density varies at 20%, 40%, and 60%. Previous investigations have resulted in non-intuitive results that contradict traditional solid mechanic theories. Stress-inducing "v" notches and elliptical holes are compared to previously tested specimens with circular holes and semi-circular stress concentrations. While the theoretical stress concentration factor can be designed to be the same between a "v" and semi-circular notch, the stress field around the notch varies with a higher maximum stress at the "v" notch due to the sharp curve. This leads to higher probability of crack initiation and propagation than traditionally expected, which will be influential in creating failure theories for 3D-printed products.

Boe, Jordan (Junior, Mechanical Engineering, Pima Community College). Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College. [ASCEND-11]

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Brooks, Hunter (Junior, Astrophysics, Northern Arizona University). Mentor: Jasmine Garani, Astronomy and Planetary Science, Northern Arizona University. [A-25]

PHOTOMETRIC AND ASTROMETRIC PROPERTIES OF ULTRACOOL SUBDWARFS

Using three new spectral models (LOWZ, ELF OWL, SAND) we calculated optimal photometric properties to discover new ultracool subdwarfs. In this search we have discovered new color-color diagrams to be used to discover new ultracool subdwarfs. Using these photometric colors we were able to determine the chemical and molecule species causing the abnormalities in these objects. Moreover, we evaluated the differences of metallicities in reduced proper motion space and the effects it has on astrometric properties.

Brown, Colin (Sophomore, Optical Sciences and Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [NEBP-5]

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The AZ South team comprises ASU, UA, and CGUHS. Our main goal is to collect and analyze high-altitude data between 70,000 to 85,000 feet during the 2023 Annular Solar Eclipse in Roswell, NM, and the 2024 Total Solar Eclipse in Uvalde, TX. Two types of data are useful to study and understand the phenomena of the moon's shadow passing the Sun: changes in the pressure, temperature, density, and wind speed against the altitudes and atmosphere's layers and live video recording of the totality and the Sun's Corona. The UA team prioritized mechanical design for the payloads, engineering suitable housings for the RFD-900 (GPS transponder) and PTERODACTYL (atmospheric data collector) while considering space, weight, and durability constraints. Verification and validation were carried out to examine the robustness of 3D filament, as well as confirm code and payload function.

Brown, Colin (Sophomore, Optical Sciences and Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

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Brown, Taylor (Junior, Space Physics, Embry-Riddle Aeronautical University). Mentor: Noel Richardson, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-9]

ANALYZING THE VARIABILITY AND ORBIT OF MASSIVE BINARY ETA CARINAE

Eta Carinae is an usually massive, highly eccentric Luminous Blue Variable (LBV) star with intense, periodic peaks in its brightness and astrophysicists have yet to find out why. We aim to more clearly and accurately describe the kinematics of the system's orbit and model the forces influencing its luminosity, ultimately providing the astrophysical community with information regarding the highly eccentric Eta Carinae system. To study this variable behavior, we are analyzing seven years of photometric data from the BRITE (BRIght Target Explorer) Constellation mission and modeling Tidally Excited Oscillations. Additionally, we are expanding on the study of Eta Carinae's orbit by analyzing new emission lines from the system. Further analysis of elemental emission lines could better constrain Eta Carinae's orbit and provide key information in the effort to explain the system's past, current, and future behaviors.

Buchanan, Zacheriah (High School Student, Engineering, Casa Grande Union High School). Mentor: John Morris, Career and Technical Education, Casa Grande Union High School. [ASCEND-6]

EXPLORING THE MARTIAN AGRICULTURE FRONTIER: ASSESSING TOMATO ADAPTABILITY THROUGH HIGH ALTITUDE EXPERIMENTATION

Our objective is to assess the viability of tomato seeds exposed to Mars-like conditions by sending them into the Earth’s stratosphere. Our high-altitude balloon payload exposes commercially bought seeds to extreme temperatures, low pressure, UV, and beta and gamma radiation. We will compare these seeds with a control group kept in our lab. Upon return, both sets will be planted in a controlled hydroponic greenhouse. Subsequent electrophoresis tests will reveal any genetic variations. As a long-term study, we'll harvest seeds from the experimental plants for future flights, aiming to observe cumulative genetic changes over five generations. This research aims to demonstrate potential genetic mutations in tomato seeds under extreme conditions, providing insights into sustainable agriculture for future Mars colonization efforts.

Burgard, Erin (Senior, Environmental Engineering, Arizona State University). Mentor: Nicholas Rolston, School of Electrical, Computer and Energy Engineering, Arizona State University. [B-11]

INDUCING PRESSURE ON SPACE PEROVSKITE SOLAR CELLS

Perovskite solar cells (PSCs) have distinct advantages over conventional silicon-based solar cells including strong electrical efficiency, and less-intensive device fabrication at low cost. The greatest impedance to PSCs being commonly used is their lack of stability in environmental conditions. This project focuses on advancing the thermal stability of PSC by inducing pressure upon the films with weights during the epoxy curing process. The samples are encapsulated with epoxy and characterized with optical microscopy and photoluminescence tests and ultimately analyzed for the effect of pressure on degradation. Developing PSCs will lead to an increase of the accessibility to solar-sourced energy, and therefore decrease humanity’s dependence on harmful carbon-based energy technologies.

Campbell, Sam (Junior, Astrobiology, Arizona State University). Mentor: Rhonda Stroud, Buseck Center for Meteorite Studies, Arizona State University. [F-8]

MAKING METEORITES ACCESSIBLE

When participating in outreach, it’s easy to forget what is considered common knowledge and what falls into ‘expert blind spots’. Meteoritics can be notorious for its heavy jargon and confusing academic papers. It’s an interdisciplinary field - chemists, physicists, geologists, astrobiologists, and so many other scientists all come together to make amazing discoveries. That work should be shared, not just with other professionals, but with the public as well. As researchers, it's imperative that work is presented in a way the average person can understand. With the goal of teaching people about meteoritics, I am working with Dr. Rhonda Stroud, director of the Buseck Center for Meteorite Studies at Arizona State University, to create a deck of playing cards featuring different meteorites from the Carleton B. Moore Meteorite Collection. With simplified definitions and fun facts on each card, meteorites can be made accessible to people of all walks of life.

Cantin, Chad (Junior, Aerospace Engineering, University of Arizona). Mentor: Shane Byrne, Lunar and Planetary Laboratory, University of Arizona. [E-2]

NASA SURVEYOR PROGRAM: SURVEYORS 1, 3, 5, 6, AND 7

NASA's Surveyor Program successfully landed five spacecraft on the Moon's surface from May 1966 to January 1968, that were designed for safety and technology tests for the Apollo missions. The program also aimed to evaluate soil properties and landing suitability. The spacecraft were equipped with imaging systems, ultimately capturing over 87,000 images of the lunar surface, which significantly enhanced our understanding of the lunar terrain. However, these images were stored on magnetic tapes and later transferred to physical 70mm film rolls. This project's initiative involves digitizing these images and archiving them alongside their metadata at NASA's Planetary Data System. The initial image digitization is complete, though further efforts are needed to quality-check and organize the metadata, as well as ensure image quality is consistent and optimal. Efforts to verify images and metadata will support further lunar research and exploration in the coming years.

Cardona, Alondra (Junior, Astronomy, University of Arizona). Mentor: Carlos Vargas, Astronomy and Steward Observatory, University of Arizona. [G-11]

ASPERA SPACE MISSION SCIENCE TARGETS AND ANALYSIS

Aspera is an extreme-UV small satellite mission designed to map the warm-hot phase coronal gas around nearby galaxy halos. The mission is funded by the NASA Astrophysics Pioneers Program and is being led by UofA's Steward Observatory with an expected launch date in 2025. Aspera is a one-of-a-kind mission designed to uncover the physical and evolutionary properties of galaxies through measuring OVI line emission from the diffuse gas of the circumgalactic medium. Mapping these OVI emission lines will allow for a better scientific understanding of how galaxy-scale gas flows will affect future generations of star formation. This internship position has allowed me to contribute to the mission by performing background literature research on physical properties of Aspera targets (e.g., star formation rates, stellar masses, recessional velocities, etc.), as well as laboratory operations in preparation for the Aspera payload build.

Carl, Naomi (Junior, Astrophysics, Physics, Arizona State University). Mentor: Sanchayeeta Borthakur, School of Earth and Space Exploration, Arizona State University. [A-2]

STAR FORMATION HISTORY OF NGC 3344

When a galaxy forms inside-out, younger stars dominate the outer disc. Previous work exemplified an inside-out growth pattern of NGC 3344 (Padave et al. 2021). NGC 3344 is a nearby, face-on galaxy; it is unique in that it has an extended UV disc, which would indicate a recent burst of star formation. However, it is not clear what would have caused this. By modeling the Spectral Energy Distribution (SED) of the galaxy, we are able to analyze the Star Formation History (SFH) of the galaxy. Using flux measurements from the Large Binocular Telescope and CIGALE, SED models for the galaxy were created. By analyzing the SFH based off of the best fit model, it was revealed that NGC 3344 had a recent starburst within the last 200 million years. These results will be able to give us clues into the formation of XUV discs in galaxies.

Carter, Beau (Sophomore, Optical Sciences and Engineering, Pima Community College). Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College. [ASCEND-11]

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CGUHS ASCEND (Casa Grande Union High School). Mentor: John Morris, Career and Technical Education, Casa Grande Union High School. [D-7]

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Our objective is to assess the viability of tomato seeds exposed to Mars-like conditions by sending them into the Earth's stratosphere. Our high-altitude balloon payload exposes commercially bought seeds to extreme temperatures, low pressure, UV, and beta and gamma radiation. We will compare these seeds with a control group kept in our lab. Upon return, both sets will be planted in a controlled hydroponic greenhouse. Subsequent electrophoresis tests will reveal any genetic variations. As a long-term study, we'll harvest seeds from the experimental plants for future flights, aiming to observe cumulative genetic changes over five generations. This research aims to demonstrate potential genetic mutations in tomato seeds under extreme conditions, providing insights into sustainable agriculture for future Mars colonization efforts.

Chumley, Ethan (Sophomore, Cyber Operations, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

UARIZONA ASCEND: HIGH-ALTITUDE DATA COLLECTION WITH A CUSTOM CUBESAT PAYLOAD

CubeSats have been a rapidly growing technology over the last decade due to their diminutive total mass to orbit while maintaining spacecraft performance. However, due to their small form factor, CubeSats are extremely limited in the amount of electronics and power storage that they can carry. Within the bounds of a standard 1U CubeSat, the UArizona ASCEND payload houses an atmospheric profiling system to collect data up to 100,000 feet. The project incorporates low power considerations, volume optimization, and high durability 3D printing to improve on the University's previous ASCEND launches. The CubeSat uses durable PETG thermoplastic polyester to ensure the safety of the housing. In addition, two traditional small form factor cameras collect unique views of Earth's atmosphere throughout the ascent and descent of the payload.

Clark, Emily (Junior, Physics, Astrophysics, Northern Arizona University). Mentor: Mark Loeffler, Astronomy and Planetary Science, Northern Arizona University. [D-10]

SPACE WEATHERING OF DARK REGOLITH AND CARBONACEOUS ASTEROIDS

Space weathering refers to the alteration of airless surfaces caused by exposure to space. Magnetite is an important component on many carbonaceous asteroid surfaces, including Bennu, the subject of NASA's OSIRIS REx mission. Recently, Chaves et al. 2023 showed that proton irradiation of magnetite caused the spectral slope between 0.7-1.0 μm to decrease (become blue) and the brightness to increase and that the surface of the magnetite was chemically reduced to metallic iron. We were interested in investigating the behavior of magnetite under simulated space weathering in detail. I prepared samples of magnetite and CI simulant and characterized the initial reflectance of the sample. Then, I placed the sample into our ultra-high vacuum system and used a laser to ablate iron metal onto the surface. With these results, I will compare how space weathering induced by iron may be different in dark materials compared to brighter silicates.

Condon, Jessica (Senior, Geology, Modern Languanges, Northern Arizona University). Mentor: Greg Vaughan, Astrogeology, US Geological Survey. [B-14]

REMOTE SENSING FOR YELLOWSTONE GEOTHERMAL AREA CHARACTERIZATION

Yellowstone National Park is located over a long-dormant, but restless volcanic system with a history of enormous eruptions. It is famous for its thermal features, like geysers and hot springs; and these features are evidence that it is still an active region. Measuring and monitoring changes in the heat output of Yellowstone's thermal areas is important for understanding the current geothermal activity and will aid in detecting any future anomalous activity. To estimate the geothermal heat output of Yellowstone's thermal areas, nighttime thermal infrared data from Landsat 8/9 satellites were analyzed. Data from the thermal areas were compared to data from non-thermal background areas to isolate just the geothermal component of radiant heat output from the thermal areas. Preliminary analysis of the total geothermal radiant heat output shows that heat output has not significantly changed over the last ten years.

Cooper, Genevieve (Senior, Computer Science, Arizona State University). Mentor: Danny Jacobs, Interplanetary Laboratories, Arizona State University. [G-10]

DEPLOYABLE OPTICAL RECEIVER APERTURE (DORA)

The deployable optical receiver aperture (DORA) aims to demonstrate 1 Gbps data rates over distances of thousands of kilometers. DORA requires an easily-accommodated host pointing accuracy of only 10 degrees with minimal stability, allowing the primary mission to continue without reorienting to communicate and/or enabling small satellite missions using low-cost off-the-shelf ADCS systems. To achieve this performance, DORA replaces the traditional receiving telescope on the spacecraft with a collection of wide-angle photodiodes that can identify the angle of arrival for incoming communication lasers and steer the onboard transmitting laser in the corresponding direction. This work is motivated by NASA's plans for a lunar communications and navigation network and supported by NASA's Space Technology Program (STP). Future implementations of the DORA technology are expected to further enable omnidirectional receiving of multiple optical communications simultaneously and accommodate multiple transmitting modules on a single cubesat.

Crook, Virginia (Junior, Physics, Astrophysics, Northern Arizona University). Mentor: Marc Hunter, USGS Astrogeology Science Center, Northern Arizona University. [F-7]

DIGITIZING EUGENE SHOEMAKER'S LEGACY

Eugene Shoemaker left an incredible impact on the Apollo program and the way that space exploration is conducted on extraterrestrial surfaces. However, his work is largely inaccessible to the general public. The Astrolink team at the Astrogeology Science Center developed a standard operating procedure to streamline the digitization process. The ultimate goal is to have a digital archive of Shoemaker's maps, report drafts, field notebooks, etc. There is historical significance in understanding how geology was incorporated into the Apollo program mission because a thorough understanding of geology is needed to explore the Moon, Mars, and beyond. An appreciation of geology's place in space exploration will guide future research missions.

Das, Ritisha (Senior, Mechanical Engineering, Mathematics, Arizona State University). Mentor: Mingming Li, School of Earth and Space Exploration, Arizona State University. [D-12]

INVESTIGATING THE CAUSE OF MARS' LARGE VOLCANOES FROM DEEP MANTLE CONVECTION

Topographically, Mars exhibits crustal dichotomy and its origin can be attributed to its mantle plumes. The large temperature differential between the mantle and core forms a thermal boundary layer in Mars' mantle. Past literature indicates one large mantle plume (volcano) forms at this boundary layer and the occurrence of transient superplumes on Mars depends on rheology and initial mantle temperatures. With increased observational data about Mars' internal structures from the geophysical InSight mission, this study aims to investigate how Mars' mantle plumes affect the surface, and we will focus on the influence of Rayleigh numbers and internal heating rates. We built 2D temperature maps and isosurface models to visualize mantle plume behavior. Coupled with numerical analysis of degree-1 spherical harmonics and statistics, the models illustrated higher Rayleigh numbers correlated with higher numbers of mantle plumes.

Dave, Nikhil (Junior, Computer Engineering, Embry-Riddle Aeronautical University). Mentor: Ahmed Sulyman, Department of Computer, Electrical, and Software Engineering, Embry-Riddle Aeronautical University. [G-5]

EMBEDDED SOFTWARE DEVELOPMENT ON THE EAGLESAT 2 MEMORY DEGRADATION EXPERIMENT

The Memory Degradation Experiment (MDE) is the scientific payload of the EagleSat 2 project, a CubeSat. It will investigate the effects of high-energy cosmic rays on various types of computer memory. MDE is an embedded system, or a computer dedicated to a specific purpose within a larger device. For EagleSat 2, MDE handles data collection from the various types of memory being evaluated. Writing the software on this embedded system has presented some unique development and testing challenges. Factors such as limited visibility into program internals and bugs related to hardware interactions demanded uncommon solutions. These solutions included, among other methods, a user menu to view program internals and signal analysis to characterize hardware traits. After addressing these challenges, a minimum viable program for MDE has been achieved, and an optimized version is mostly complete and undergoing testing.

De La Torre Perez, Jose (First-Year, Systems Engineering, Arizona Western College). Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma. [ASCEND-9]

EXPLORING ATMOSPHERIC DYNAMICS: A COLLABORATIVE ENDEAVOR IN AIR QUALITY RESEARCH

This project is a collaboration between Arizona Western College, University of Arizona-Yuma, and Arizona State University Online on a first payload from the Western Engineering Science and Technology (WEST) Club. Students decided to investigate air quality as a function of altitude. For this first iteration, students determined that it would be practical to concentrate on retrieving data from one sensor and the payload's structure. With the data collected on temperature, pressure, and altitude, we can discern the correlation between temperature and pressure with varying altitudes. The team split into two groups: hardware/software and structural. The hardware/software team used Arduino hardware and coding alongside a microSD card. Meanwhile, the structural team used a junction box and Styrofoam, among other materials, to create the payload. This experience helped students learn how their courses are applied to real-world engineering projects while conducting research that could benefit humanity.

Derrick, Tyler (Sophomore, Aerospace Engineering, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [NEBP-5]

TRACKING STRATOSPHERIC PAYLOADS

The Arizona Eclipse Ballooning Project, a team working under the wider Nationwide Eclipse Ballooning Project, is a high-altitude ballooning project. Our goal is to analyze Earth's upper atmosphere (between 70,000 and 90,000 feet) during the 2023-2024 Eclipse Season. This is done by deploying a latex stratospheric balloon carrying several payloads collecting a variety of data, including pressure fluctuations, temperature decrease, or humidity change. These are compared with a specially built weather station at our control center. More excitingly, we are hoping to livestream the Solar Eclipse in April with a uniquely configured Raspberry Pi system. This livestream is streamed over a Ubiquiti radio connection to our ground station antenna. In order to maintain the stream connection, the ground station utilizes GPS information to determine the location of the balloon. This is used to track the balloon for the entirety of the flight, and provide a clear and consistent connection.

Dinh, Quang Huy (Sophomore, Aerospace Engineering, Aeronautic, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [ASCEND-4]

ANALYSIS OF EXTRATERRESTRIAL RADIATION'S IMPACT ON OZONE AND ITS IMPLICATIONS FOR CLIMATE AND HEALTH ON A HIGH-ALTITUDE BALLOONING PAYLOAD

In Fall 2023, the purpose of the ASCEND flight was to complete a Meteorology science mission. The meteorological mission used pressure, internal and external temperature, GPS, and accelerometer to monitor barometric pressure in relation to the storm system passing through Arizona during that launch. In Spring 2024, ASCEND used a UV sensor and Geiger-Müller tube to explore the link between solar wind radiation, UVB radiation, and ozone layer dynamics. Post-flight, correlations between radiation levels and ozone layer effects were analyzed in order to determine extraterrestrial radiation's impact on ozone and its implications for climate and health. Overall, ASCEND created a reusable design for the printed circuit board (PCB) and designed an advanced payload capable of withstanding a flight in the atmosphere and impact landing, while keeping its contacts intact.

Do, Jacqueline (Sophomore, Electrical Engineering, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [NEBP-5]

ARIZONA ECLIPSE BALLOONING PROJECT

The AZ South team comprises ASU, UA, GCC, and CGUHS. Our main goal is to analyze atmospheric data between 70,000 to 85,000 feet during the 10/14/23 Annular Solar Eclipse in Roswell, NM, and the 04/08/24 Total Solar Eclipse in Uvalde, TX. Two types of data are useful to study and understand the phenomena of the moon's shadow passing the Sun: (1) changes in pressure, temperature, density, and wind speed against the altitudes and atmosphere's layers and (2) live video recording of the totality and the Sun's corona. To achieve these feats, we have to (a) determine a suitable weather balloon launch time, launch site, expected altitude during the totality, and landing location, (b) integrate payload housings to ensure the integrity and functionality of all systems, (c) establish ground station communication of the Raspberry Pi video streaming and Ubiquiti's long-range network and (d) control the balloon's vent/cutdown via Iridium satellite.

Drango, Derrick (Sophomore, Mechanical Engineering, Embry-Riddle Aeronautical University). Mentor: Pragati Pradhan, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-12]

UNVEILING THE SECRETS OF NEUTRON STARS; X-RAY ASTRONOMY WITH SPECTRO-TIMING ANALYSIS

Measuring the radius of the neutron star is a challenging task owing to its small size and extreme density. This is because a neutron star is the collapsed core of a massive supergiant star. While one can indirectly infer the radius by methods of pulsar timing, burst analysis is the most direct method to make such measurements. There have been debates in literature about the actual radius of these stars as it has implications in understanding their composition. Additionally, while it is not possible to directly image space-time curvature near the neutron star, we can measure gravitational red-shift of the iron line to make estimates as well. We aim to study the behavior of a Low mass X-ray binary (LMXB) EXO 0748-676 by performing detailed Spectro-timing analysis with Chandra during and after bursts. The importance of this research is to understand the extreme astrophysical phenomena and the conditions of matter.

Duran, Penny (Sophomore, Physics, University of Arizona). Mentor: Daniel Stolte, University Communications, University of Arizona. [F-4]

SCIENTIFIC WRITING AT UARIZONA'S UNIVERSITY COMMUNICATIONS

Communicating scientific research to audiences outside of the scientific community can be challenging. Science communicators use storytelling techniques to make research more accessible and easier to understand for audiences without a technical background. In the University of Arizona's central communications office, we communicate science by finding a human angle and connecting research to everyday experiences. Working closely with scientists through interviews, we produce news stories and press releases about noteworthy discoveries and interesting research projects. While translating complex science into engaging stories, we avoid oversimplification and sacrificing accuracy by having scientists vet our stories prior to publication. Notable stories I produced during my internship include an asteroid discovery citizen science program and a news release about the role of sulfur in the origin of life. These stories provide relevance and broader societal impact, help increase funding opportunities, and make it possible for scientists to reach wider audiences.

Earley, Conor (Senior, Astrophysics, Arizona State University). Mentor: Nathaniel Butler, School of Earth and Space Exploration, Arizona State University. [D-5]

ATMOSPHERIC REVELATIONS: PROBING EXOPLANETS COMPOSITION AND STRUCTURE THROUGH INNOVATIVE INSTRUMENTATION

With over 5,500 exoplanets discovered to date, we still know very little about their atmospheric composition, thermal structure, and dynamics. Previous efforts to characterize exoplanet atmospheres has largely relied on space-based observatories such as HST or Spitzer. While space-based observatories can achieve the highest levels of spectrophotometric precision, neither HST nor Spitzer has the near-infrared coverage to unambiguously map the temperature profile and chemical composition for close-in exoplanets. In this talk, we will explore the development of the EXoplanet Climate Infrared TElescope (EXCITE) – a balloon borne telescope and spectrograph – that will address this scientific gap by continuously observing extrasolar giant planets (EGPs, or "hot Jupiters") for their full orbital period. The data gathered from EXCITE, combined with 3D general circulation models (GCMs), will be used to study the planetary dynamics of highly irradiated planets while also improving GCMs predictive power when applied to future datasets from other telescopes.

Easton, Madison Marie (Senior, Biological Sciences, Spanish, Northern Arizona University). Mentor: Chris Etling, Arizona Daily Sun. [F-3]

THE SCIENCE OF STORYTELLING: SCIENCE JOURNALISM AT THE ARIZONA DAILY SUN

Access to scientific information is often unattainable for the public due to paywalls and overly academic terminology. Barriers to knowledge make concepts difficult for laypeople to understand, leading to disinterest or disregard. Journalism is a way of translating complex information from a variety of sources and creating something both interesting and digestible for anyone to access. At its most fundamental, science is curiosity, and when its complexities can be made straightforward, the excitement that surrounds it can flourish. Through science journalism, a beautiful melding of intricacies and curiosity manifests itself into a medium that makes science accessible to anyone willing to explore it. Examples of published works through the AZ Daily Sun include a piece on the annual Flagstaff Festival of Science with an angle on youth education in the sciences, a brief on research that ties anticholinergic medications to dementia, and a feature on the upcoming NASA Artemis training.

Elalaoui-Pinedo, Dora (Sophomore, Planetary Geoscience, University of Arizona). Mentor: Sarah Sutton, Lunar and Planetary Laboratory, University of Arizona. [D-6]

MAPPING ENIGMATIC PITS IN THE NORTH POLAR LAYERED DEPOSITS OF MARS

The North Polar Layered Deposits (NPLD) are layers of dust and water ice within Planum Boreum, Mars's north polar ice cap. The NPLD consists of profound spiral troughs, whose walls carve into the deposits and expose the layers. Intriguing features within the NPLD are pits of unknown origin, which typically appear circular, meter-sized, along troughs, and deeply shadowed. Using images from the High Resolution Imaging Science Experiment (HiRISE) on the NASA Mars Reconnaissance Orbiter, we can locate and investigate pits in the NPLD. We are using QGIS, a geographic information system, to map their locations to explore their formation mechanisms, active surface processes, potential faults, and ice sublimation or deposition. Ultimately, studying the pits is unexplored research that may further explain the structure of the NPLD and advance our knowledge of Mars's climate history.

Elstad, Sonja (Sophomore, Electrical Engineering, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CAC BETA X

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Englund, Octavian (Sophomore, Computer Science, Glendale Community College). Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College. [ASCEND-7]

GCC ASCEND, TEAM ICARUS: TESTING NEW DIGITAL SENSORS AND DETECTING UV LIGHT

During the fall semester, the ASCEND teams at GCC designed and built payloads that were attached to a high-altitude weather balloon, which rose to over 100,000ft. These payloads successfully measured temperature, pressure, and acceleration with analog sensors, while also recording video throughout the flight. Starting with this basic design, during the spring semester our team also measured ultraviolet light and used two new I 2 C digital sensors; one was a three-axis accelerometer and gyroscope, while the other measured temperature and pressure. Including these new digital sensors allowed for a direct comparison between the data collected with analog and digital sensors. The payload also included a GPS sensor and an Iridium modem to transmit data via satellites every 5 minutes. This allowed our team to track the payload's path during its flight independent of the GPS information provided by ANSR, while also correlating the data collected with the payload's altitude.

Esparza, John (Junior, Biosystems Engineering, University of Arizona). Mentor: Mary Nichols, USDA-ARS Southwest Watershed Research Center. [B-10]

EARTHWORKS AND ECOSYSTEMS: A WEB-BASED TOOL FOR VEGETATION MONITORING IN THE ALTAR VALLEY

Located in southeastern Arizona, the Altar Valley is a semiarid rangeland watershed that has been utilized for grazing since the early 1900s. Hundreds of berms – man-made earthen structures – have been constructed across the landscape to enhance soil moisture and control erosion. As a result, berms can impact distribution of the natural vegetation, which remains poorly documented. Our objective was to develop a web application to analyze vegetation patterns proximal to these berms using satellite imagery. We used Google Earth Engine, a cloud-based geospatial analysis platform, to quantify vegetation greenness using two commonly-used vegetation indices (NDVI and SAVI). The user selects a berm, and the web application then displays a timeseries chart depicting the user-chosen vegetation index values both upslope and downslope of the chosen berm. This tool can provide land managers with new information to support management decisions, and can be applied to other areas of interest.

Falk, Liam (Junior, Applied Physics, University of Arizona). Mentor: Jeong-Yeol Yoon, Biomedical and Biosystems Engineering, University of Arizona. [B-2]

AIRBORNE AND AQUATIC MICRO-NANO PLASTIC DETECTION BY MACHINE-LEARNING-ASSISTED MULTISPECTRAL IMAGING AND MICRO-CHANNEL FLOW ASSAYS

Plastics degrade mechanically and chemically in the environment to form micro- and nanoplastics (MNPs). These plastics (<1µm to 5mm) are known to cause cytotoxicity in human cell lines, penetrate biological barriers, and disrupt cell metabolism. Due to the limitations of current detection methods, this two-phase project aimed to develop a cheap and effective means to detect airborne and aquatic MNPs. In Phase 1, a smartphone camera with acrylic filters imaged cryo-ground samples of LDPE, Nylon, PET, etc. exposed to LED light. Machine learning processed RGB data and the algorithm tested an 87.16% accuracy for distinguishing different plastic types. In Phase 2, a microfluidic platform "BEAVVER" was developed through CAD modeling, 3D printing, and machine fabrication. On this platform, different MNP-reagent aquatic solutions will be released into a paper-porous medium with the flow velocities measured. Successful detection of MNPs will allow governmental entities to quantify their threat to local populations.

Felder, James (High School Student, Raymond S. Kellis). Mentor: William Chernoff, Sociology and Criminal Justice, Southeastern Louisiana University. [G-6]

SATELLITE RESEARCH

The present study aims to answer the research question: ""Why do some manmade satellites in orbit last longer than other satellites?"" To investigate this topic, satellites (N = 170) were sampled on December 2nd, 2023 from eoPortal.com, a public satellite database maintained by the European Space Agency (ESA). The sample consists of all space and weather/climate satellites whose missions had been completed and excludes resupply missions, rockets, and unlaunched satellites. The data show that satellites that cost more to build and launch (adjusted for inflation), that were built during the Cold War era, and that did not have mechanical issues were operational for a longer duration of months. Based on the above findings, satellite manufacturers and space organizations should use spend more money, implement greater quality control measures, and review satellites produced during the Cold War era for best practices.

Ferrell, Hayden (Sophomore, Astrobiology and Biogeosciences, Biophysics, Arizona State University). Mentor: Elizabeth Trembath-Reichert, School of Earth and Space Exploration, Arizona State University. [B-9]

CELL SIZE AND TEMPERATURE

Under environmental pressures, cells must change in order to adapt and survive in their environment. This project is trying to understand how Pseudomonas putida, a rod-shaped mesophilic bacteria, changes when in a colder environment. In order to understand this change, the cells are grown in different temperature environments. They are then compared with their area and perimeter, and area/perimeter ratio in order to understand how they change under these pressures. Furthermore, in order to understand how cells more acutely change, some of the cells were "shocked" by growing for part of the time in a warmer environment, and then placed in a colder environment for the rest of the experiment. This project will help to better understand the mechanisms employed by bacterial life to adapt to a changing environment.

Fisher, Cortney (Sophomore, Electrical Engineering, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CENTRAL ARIZONA COLLEGE - NASA ASCEND

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Freeman, Greta (Junior, Geology, Northern Arizona University). Mentor: Chris Okubo, USGS Astrogeology Science Center. [D-1]

MAPPING MOUNDS IN UTOPIA PLANITIA TO INVESTIGATE THE ORIGINS OF MARTIAN VOLCANIC FEATURES

The Utopia Planitia region of Mars contains thousands of enigmatic mounds that may have formed through igneous or sedimentary processes. While similar features are found on Earth, formed by erupting fluid-rich sediment driven by subsurface pressures, the origin of the features on Mars is still being debated. This project aims to map several varying morphologies of these mounds along Utopia Planitia's border in order to get a statistical idea of the elevation distribution of mound proportions and to characterize the spatial relationship between the volcanic features and the surrounding geologic units. JMARS was used to record mound locations and ArcGIS was used to associate the mounds with their respective geologic unit. Data interpretation suggests that the mounds' morphology strongly correlates with elevation, which may provide clues to the subsurface environment. Results of this study will be combined with similar data from other regions of Mars to support future surface research.

Fronmueller, Simon (Junior, Astrobiology, Biogeosciences, Arizona State University). Mentor: Everett Shock, School of Earth and Space Exploration, Arizona State University. [B-18]

A TALE OF TWO TRACE METALS: A YELLOWSTONE MYSTERY

Ammonia-oxidizing archaea (AOA) and bacteria are some of the most abundant organisms on Earth. Despite this, ammonia-oxidizers are seemingly absent from many Yellowstone National Park (YNP) hot springs where conditions appear suitable. Why is this? One possible explanation is that ammonia-oxidizers require copper and iron as enzymatic cofactors. Thus, low concentrations of bioavailable copper and iron in hot springs may limit or prevent their growth. In an effort to solve this, we have conducted geochemical analysis of several years of YNP hot spring field data. Specifically, plotting the molality of copper and iron in these springs as well as the mole percent of different species of copper and iron against pH. Currently, we are working on verifying the results of our geochemical analysis by creating cell cultures of known AOA collected from YNP using media with varying concentrations of copper and iron and measuring the effect on growth rates.

Fry, Rachel (Senior, Physics, Astrophysics, Northern Arizona University). Mentor: Devon Burr, Astronomy and Planetary Science, Northern Arizona University. [D-4]

ANALYSIS OF DUST PRODUCED BY EXPERIMENTAL AEOLIAN TRANSPORT OF MARS-ANALOG SANDS

Wind has been a dominant process of sediment transport on Mars for 3.6 billion years, with sand and dust ubiquitous across Mars' modern surface. While Mars can exhibit globe-spanning dust storms, the origin of this dust is unknown. However, as seen in previous experimental studies, sand-sized grains undergo collisions with other grains or bedrock as they are transported by wind, which can remove dust-sized particles from the grains. This study seeks to examine dust produced by this wind-driven, or aeolian, transport of a suite of Mars-analog sands using the Mill for Aeolian Experiments (MAE). The MAE uses pressurized air to circulate sediment around a chamber of bound silicon carbide grit, simulating the collisions experienced during aeolian transport. The dust produced by these experiments will be sieved, weighed, and analyzed for its mineral composition, allowing us to determine the comparative contribution to dust by different types of sediment on Mars.

Fuse, Cameron (Sophomore, Environmental Engineering, University of Arizona). Mentor: Mónica Ramírez-Andreotta, Environmental Science, University of Arizona. [B-5]

WILDFIRES WORKING TO RELEASE AND REMOBILIZE CONTAMINANTS IN RURAL ARIZONA

There are two things that Arizona has a plentiful amount of: Mines and Wildfires. This project investigates the extent that heavy metal/metalloids transfer from rural Arizona mines to the surrounding vegetation via soil. Specifically, the composition of dust particles created while these vegetation are combusted during wildfires. This is important to analyze, as nearby communities will be at an increased health risk, being exposed to these particles as they become airborne. The communities of concern in the project were Globe, Miami, and Superior, Arizona, all in close proximity to the Telegraph Fire of 2021. After a review of regionally-based plants and in partnership with the U.S. Forest Service, plant samples were collected from the Tonto National Forest and will be prepared for burning and chemical analyses. Results are ongoing, however the expectation is to find elevated metal/metalloid concentrations when compared to unburned vegetation.

Garayzar, Elizabeth (Junior, Technological Leadership, Geographic Information Science, Arizona State University). Mentor: Eric Stribling, Interplanetary Initiative, Arizona State University. [B-In Title Only]

LEVERAGING GIS TECHNOLOGY FOR WILDFIRE RESPONSE ANALYSIS IN MAUI

Maui is facing a significant increase of wildfires exacerbated by climate change. In August 2023 the island experienced the deadliest wildfire in the U.S. in over a century. Using Google Earth Engine, an open-source GIS technology, this in-depth analysis of environmental, topographic and demographic features identifies the fire-inducing factors in the area and lack of sufficient action from local authorities. A geographic and social analysis were conducted to model high-low risk areas of danger all over the island as well as potential safe havens for future fires. This study emphasizes the immediate need for proactive measures in communities affected by natural disasters.

Garcia, Lorynn (Sophomore, Aerospace Engineering, Phoenix College). Mentor: Eddie Ong, Physical Sciences, Phoenix College. [ASCEND-10]

ENHANCING LAUNCH DYNAMICS: INTEGRATING SENSORS AND STABILIZATION FOR ADVANCED ATMOSPHERIC ANALYSIS

The Phoenix College NASA ASCEND team has maintained a longstanding engagement in launch activities. Our focus revolves around enhancing fabrication techniques and standardization protocols for components within our carbon fiber reinforced vehicle. Integration of sensors for light experiments is underway to facilitate altitude-dependent measurements and to capture behavioral data of the vehicle during launch sequences. Notably, for the

Spring 2024 launch, our endeavors extend to deploying two Geiger counters: one for beta and gamma radiation assessment across altitudinal gradients, with the other aimed at neutron detection at varying elevations to ascertain the Pfotzer–Regener maximum. Concurrently, efforts are directed towards refining stabilization of captured videos, with the incorporation of an upward-looking camera for enhanced observation. Additionally, a pre-launch cooling mechanism has been devised and implemented to optimize vehicle performance.

Garland, Henry (Sophomore, Chemistry, Northern Arizona University). Mentor: Stephanie Hurst, Chemistry and Biochemistry, Northern Arizona University. [E-3]

TRANSPARENT CONDUCTIVE OXIDES FOR QUANTUM OPTICAL DEVICES: A COMPUTATIONAL APPROACH

Computational methods can be used to guide transparent conductive oxide (TCO) research. These computational techniques are useful for quickly analyzing and predicting TCO properties, such as Indium Tin Oxide's (ITO) electronic and optical properties. Previous studies have analyzed the electronic structure of ITO using density functional theory (DFT), however there is little information on how sodium-ion doping affects the electronic and optical properties. In my research, DFT calculations have been used to predict the electronic and optical properties of ITO with and without sodium-ion doping. These calculations can then be compared to the experimentally obtained optical band gap data from Tauc plots. UV-Visible spectroscopy data was collected and analyzed via Python scripts to create Tauc plots. By developing methods to accurately predict TCO properties, novel applications in quantum networks, solar cells, light emitting diodes, and optoelectronics can be efficiently explored, thus promoting innovation in the field.

Garza, Gabriella (Junior, Biomedical Sciences, Northern Arizona University). Mentor: Catherine Gehring, Center of Adaptable Western Landscapes, Northern Arizona University. [B-7]

TAMARISK AND MYCORRHIZAL FUNGAL ASSOCIATIONS IN SALIX EXIGUA

Tamarisk, an invasive shrub species, significantly changed its surrounding environment. Specifically, Tamarisk alters the amount of mycorrhizal fungi seen in nearby soil. The purpose of this experiment is to examine how Tamarisk affects the mycorrhizal fungal associations in Salix exigua roots. Recent studies have revealed that Tamarisk decreases the mycorrhizal fungal associations in Cottonwood tree roots, negatively impacting the tree's growth. However, the impact Tamarisk has on the mycorrhizal fungal associations in Salix exigua roots is unknown. Wewill observe the effects of Tamarisks by growing sixty Salix exigua plants in one of two soil types. Thirty will be grown in soil collected near Tamarisk, while the remaining will be grown in non-Tamarisk soil. Once grown, we will analyze their roots for mycorrhizal fungal associations. Our results suggested that Tamarisk causes a decrease in mycorrhizal fungal associations in Salix exigua roots. Additionally, Salix exigua grown in Tamarisk soil had a larger biomass in comparison to the control group. The reason as to why Tamarisk caused an increase in Salix exigua biomass is unknown.

Geen, Emily (Junior, Engineering, Casa Grande Union High School). Mentor: John Morris, Career and Technical Education, Casa Grande Union High School. [ASCEND-6]

EXPLORING THE MARTIAN AGRICULTURE FRONTIER: ASSESSING TOMATO ADAPTABILITY THROUGH HIGH ALTITUDE EXPERIMENTATION

Our objective is to assess the viability of tomato seeds exposed to Mars-like conditions by sending them into the Earth's stratosphere. Our high-altitude balloon payload exposes commercially bought seeds to extreme temperatures, low pressure, UV, and beta and gamma radiation. We will compare these seeds with a control group kept in our lab. Upon return, both sets will be planted in a controlled hydroponic greenhouse. Subsequent electrophoresis tests will reveal any genetic variations. As a long-term study, we'll harvest seeds from the experimental plants for future flights, aiming to observe cumulative genetic changes over five generations. This research aims to demonstrate potential genetic mutations in tomato seeds under extreme conditions, providing insights into sustainable agriculture for future Mars colonization efforts.

Gruber, Hannah (Sophomore, Astronomy, Physics, University of Arizona). Mentor: Yancy Shirley, Astronomy and Steward Observatory, University of Arizona. [A-19]

A COMPARATIVE DEUTERATION SURVEY OF STARLESS CORES

Before stars form, their material exists as dense clouds of gas and dust called starless cores whose chemistry can tell us about their composition and their evolution. This project used the 12m Telescope on Kitt Peak to observe the deuterated molecules DNC, NH2D, and N2D+ in the dense centers of twelve starless cores in the Barnard 10 region of the Taurus Molecular Cloud. These observations are used to determine and compare the differences in abundances between regular and deuterated molecules. In the extremely cold (~ 10 K), dense gas (> 10^5 H2 molecules/cm^3) in these starless cores, deuterium fraction should generally increase in time and can therefore be used as a metric to compare the rate of evolution of starless cores. Ratios between different molecules' intensities are compared with each other, and analyzed with regards to the evolutionary state of these cores.

Grullon, Somaralyz (Senior, Mechanical Engineering (Robotics), Embry-Riddle Aeronautical University). Mentor: Yabin Liao, Aerospace Engineering, Embry-Riddle Aeronautical University. [ASCEND-2]

LONG-DISTANCE VIDEO AND TELEMETRY STREAMING

This project involves testing the performance of a radio 2.4GHz as well as sensor data. The payload, attached to a high-altitude balloon, will transmit live video and telemetry over the 2.4GHz frequency. The signals will be received with high-gain antennas on a tracking ground station, and the onboard SD card will collect the same telemetry data for comparison purposes. Additionally, a microcontroller (Adafruit feather STM32405) equipped with sensors will be used to determine the location of the payload in 3D space and its orientation. The sensors used for data collection include a UV light sensor, spectrograph, IMU, barometer, GPS, and a Geiger counter. The projects goal is to characterize the quality and range of these 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.

Guaglardi, Lucas (Senior, Aerospace Engineering, Arizona State University). Mentor: Timothy Takahashi, School for Engineering of Matter, Transport and Energy, Arizona State University. [C-In Title Only]

STOCHASTIC SUAS AIRCRAFT PERFORMANCE PREDICTION

This project entails the development of a low-speed, unmanned aerial vehicle non-real-time stochastic mission simulation code, which would then be used to conduct trade studies with ModelCenter for the development of a small unmanned aerial system (sUAS). Several models will be assembled, including but not limited to aerodynamic, propulsion, mass properties, and even a weather model. The multi-degree of freedom flight trajectory simulation code will generate kinematics and load data to support the design of the said vehicle for components such as the main wing torque box structure and payload sizing. For traditional aircraft, equivalent still air distances are used since the aircraft are faster than the wind. However, sUAS systems can potentially be slower than the wind; thus, going into a headwind equal to the top speed of the vehicle results in zero ground speed. Thus, by considering an unsteady atmosphere, propulsion, aerodynamics, and other factors can be considered.

Haan, Abigail (Junior, Chemical Engineering, University of Arizona). Mentor: Vasiliki Karanikola, Environmental Engineering, University of Arizona. [B-4]

INTERMITTENT AND CONTINUOUS OPERATION OF AN OFF-GRID SOLAR NANOFILTRATION SYSTEM

Many residents of the Navajo Nation have difficulties accessing safe drinking water. Many of the households that lack water infrastructure are not connected to the electrical grid. To address these issues, we have developed an off-grid solar nanofiltration (SNF) system and we are examining the boundaries of safe operation, as the system is built by components used in water treatment plants that are operated by trained personnel under continuous operation. This study explores the effects of continuous and intermittent operation of the SNF system on membrane flux and rejection. We test intermittently to replicate field operation and continuously to replicate industry-scale operation. We use water solutions composed of two inorganic salts, calcium chloride and magnesium sulfate, in environmentally relevant concentrations. Results show there is a decrease in average calcium rejection and a decrease in flux at the start of each intermittent run.

Hardt, Tatum (Senior, Environmental Science, Northern Arizona University). Mentor: Darrell Kaufman, School of Earth and Sustainability, Northern Arizona University. [B-12]

SEDIMENTARY ANALYSIS OF EKLUTNA LAKE, ALASKA, TO UNDERSTAND GLACIER FLUCTUATIONS OVER THE PAST 9,600 YEARS

Evidence from proglacial lake sediments was used to reconstruct changes in Eklutna Glacier size over the past 9,600 years. Anchorage, AK depends on freshwater and hydropower provided by Eklutna Glacier, which is rapidly retreating. Eklutna Lake sediment cores were used to create an age-depth model based on 14C ages and volcanic ash layers to understand glacier fluctuations using proxies. Biogenic silica measures diatom productivity, which is determined by glacier cover. Larger glaciers generate more rock flour that increases lake water turbidity and sediment accumulation rate at the lake floor, limiting growing conditions in the photic zone that reduces diatom abundance. The results indicate that Eklutna Glacier was smaller before 5000 years ago and larger thereafter, agreeing with other studies in the region. This study provides insight into how glaciers responded to past temperature changes and can help infer how glaciers will change in the future due to human-induced warming.

Henggeler, Calvin (Senior, Computer Engineering, Embry-Riddle Aeronautical University). Mentor: Ahmed Sulyman, Department of Computer, Electrical, and Software Engineering, Embry-Riddle Aeronautical University. [F-1]

PROJECT MANAGEMENT PRACTICES FOR UNDERGRADUATE SPACE PROJECTS

Undergraduate STEM and research projects can be large and complex, sometimes spanning multiple months to years and using upwards with hundreds of thousands of dollars. Pure engineering and technical skill are no longer sufficient in these projects to ensure they stay on track in both time and budget. Common project management tools and techniques for schedule, stakeholder, and resource/personnel management can be deployed by team leadership to improve the efficiency of the team and mitigate project failure points. Implementing project management practices on the Embry-Riddle Aeronautical University EagleSat-2 team has shown to be highly effective for driving the project forward and successfully meeting deadlines for test readiness. Learning to implement project management tools and practices can benefit any project in keeping an accurate timeline and orchestrating resources in accomplishing technical tasks.

Howard, Landri (High School Student, Software and App Design, Casa Grande Union High School). Mentor: John Morris, Career and Technical Education, Casa Grande Union High School. [ASCEND-6]

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Hrabak, Cameron (Senior, Biomedical Sciences, Northern Arizona University). Mentors: Christopher Doughty and Michael Gowanlock, School of Informatics, Computing, and Cyber Systems, Northern Arizona University. [D-9]

PHOTOSYNTHETIC POTENTIAL ON TRAPPIST-1E: MODELING FOR EXOPLANETARY LIFE

This research project, supported by a NASA Space Grant, introduces an innovative photosynthetic model tailored to the unique environmental conditions of TRAPPIST-1e, a tidally locked planet 40 light years away from Earth that lies within the habitable zone of the TRAPPIST-1 system's red dwarf star. Our objective was to develop a Net Primary Production (NPP) model simulating hypothetical plant life, leveraging spectral data analysis to infer the planet's atmospheric composition and surface conditions. The model utilizes simple yet pivotal parameters: light intensity, temperature, and precipitation patterns. These parameters are crucial given TRAPPIST-1e's perpetual daylight on one hemisphere and the potential for extreme temperature gradients. Our findings suggest that photosynthesis could plausibly occur, offering insights into how terrestrial plants might adapt to a tidally locked exoplanet. The implications of this research extend to the search for life in the universe and the prospect of terraforming and long-term space habitation.

Hugon, John Lucas (Sophomore, Physics, University of Arizona). Mentor: Eduardo Rozo, Physics, University of Arizona. [A-In Title Only]

A Fast, Physically Motivated Halo Finding Algorithm

Dark matter halos play a crucial role in shaping the large-scale structure of the Universe, yet defining them accurately in cosmological simulations remains challenging. Traditional methods define halos based on arbitrary fixed density thresholds. In this work, we propose an orbiting/infalling algorithm that identifies dark matter halos based on the dynamical properties of particles around halo seeds. By using particle parameters available at a single point in time, our algorithm improves efficiency without significantly sacrificing accuracy as compared to an orbiting/infalling split using data across multiple simulation time scales. We demonstrate that the algorithm's effectiveness is preserved when using a cut based on particle kinetic energy and distance from the halo center. Our findings suggest that this approach offers a precise and efficient way to define dark matter halos in cosmological simulations.

Islambekov, Samirbek (Sophomore, Computer Science, Glendale Community College). Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College. [ASCEND-8]

GCC ASCEND Project 2: Payload Sensors and Live Data Transmission

The ASCEND program at Glendale Community College is a two-semester course that takes students through the process of building small payloads to fly on a high-altitude weather balloon for the purpose of gathering data. Students are divided into 2 teams, with each payload required to be under 680g, (1.5-lb). During the fall semester, students etched and drilled a custom circuit board, and an Arduino Pro Microprocessor was then soldered onto it. Both payloads successfully measured the internal and external temperatures, acceleration, pressure, and battery voltage, while recording video throughout the flight. For the spring semester, our team’s payload was designed to also include a Geiger counter, a GPS module, an external microphone, a satellite modem to send live data in five-minute intervals, and a piezo-electric buzzer programmed to sound once payload landed. This application of theoretical knowledge to a real-world engineering project has helped prepare students for future STEM careers.

Johnson, Ethan (Senior, Chemistry, Arizona State University). Mentor: Hilairy Hartnett, School of Earth and Space Exploration, Arizona State University. [B-17]

Dielectrophoretic Characterization of Micron-Sized Mineral Particles

Carbon circulates throughout the environment in various forms, including organic carbon (OC), until ending up in a sink. Seafloor sediments are a remarkably efficient sink for OC, especially in oxygen-deficient and coastal zones. This long-known correlation still lacks a mechanistic explanation. Characterizing this mechanism will improve our understanding of carbon sequestration and biosignature preservation. Dielectrophoresis is a technique that involves the application of a non-uniform electric field to induce dipoles in particles, separating them based on unique dielectric properties. In this investigation, gradient insulator-based dielectrophoresis was used to characterize the behavior and properties of 1-5 µm particles of natural sediments and pure minerals. Samples were observed in a microchannel as a voltage was applied. As the particles moved through the channel, their behavior around insulating "gates" of decreasing width was recorded. Observations show that some samples with OC behave differently from samples without OC, though not in the anticipated way.

Kalish, Taylor (Junior, Physics, Mathematics, University of Arizona). Mentor: J. Serena Kim, Astronomy, University of Arizona. [A-10]

AN INVESTIGATION OF THE MOTION OF YOUNG STELLAR OBJECTS IN NGC 1977, WITH A FOCUS ON EXTERNALLY PHOTOEVPORATING PLANET FORMING DISKS

Investigating the role of star forming environments is crucial to understanding the origin of the Solar System and planet formation. We have been studying young stellar objects (YSOs) in NGC1977, a 1-2 million year old cluster in the Orion star forming region, located about half a degree north of the Orion Nebula Cluster. 42 Ori, a B star, is the dominant ionizing source, which emits UV radiation up to 3000 times as intense as that of our solar neighborhood. This level of radiation is typical amongst other star forming environments. Such strong radiation has been observed to externally photoevaporate planet forming disks, known as proplyds, surrounding YSOs. Using data from Gaia DR3, SDSS/APOGEE-2, Spitzer, Chandra, and ground-based telescopes, we have studied the kinematics, membership, age, and disk properties of the YSOs. Our study will shed light on understanding disk evolution and planet formation in most common star forming environments.

Kohm, Jack (Junior, Physics, Astrophysics, Northern Arizona University). Mentor: Lisa Chien, Astronomy and Planetary Sciences, Northern Arizona University. [A-3]

DARK MATTER MODELS AND THEIR IMPACT ON STELLAR STREAM MORPHOLOGY

Stellar streams provide insights into the Milky Way's (MW) dark matter (DM) profile and the nature of DM. We investigate Cold Dark Matter (CDM) and Self-Interacting Dark Matter (SIDM) effects on stellar stream kinematics and morphology using high-resolution cosmological-baryonic simulations from the FIRE-2 project, focusing on Sagittarius dSph galaxy analogs in MW-mass galaxies at $z=0$. Using consistent initial conditions, only the DM model was varied. Both CDM and SIDM streams initially showed similar kinematics, but at $z=0.95$, differences in their host halos' DM density profiles became evident. The SIDM halo had a cuspier profile than CDM, leading to thinner, more elongated streams with a younger stellar age distribution due to tidal disruptions inhibiting star formation. These differences suggest stellar stream features can trace the gravitational potential evolution of their host and offer insights into DM nature, highlighting the impact of DM interactions on galaxy formation and evolution.

Kupersmith, Alexandra (Junior, Physics, Astronomy, University of Arizona). Mentor: Steve Kortenkamp, Lunar and Planetary Laboratory, University of Arizona. [F-9]

MARS IN 3D: CREATING ACCESSIBLE PLANETARY SCIENCE EDUCATION

With over 20 million Americans having visual impairments that render visual aids ineffective in educational settings, these underrepresented students miss out on opportunities and experiences necessary to pursue STEM fields. As an extension of an NSF-funded program to develop STEM curriculum for the visually impaired (Touching the Solar System), our project aims to expand planetary science curricula into an accessible university-level general education course. Utilizing models included in the previous program and generating new terrain models of Martian topography, we provide the scaffolding for the additional curriculum necessary to expand the previous course. This educational scaffolding begins with the 3D rendering and printing of topographic Mars models, creation of silicon molds of said prints that are later casted, and casting duplicates to avoid needing to invest the often inaccessible resources to repeatedly reprint. These models are then used to supplement developed curricula which further inspires tactile exploration in education.

Kwolek, Andrew (Senior, Systems Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [NEBP-5]

NATIONWIDE ECLIPSE BALLOONING PROJECT SOUTH

The AZ South team comprises ASU, UA, and CGUHS. Our main goal is to collect and analyze high-altitude data between 70,000 to 85,000 feet during the 2023 Annular Solar Eclipse in Roswell, NM, and the 2024 Total Solar Eclipse in Uvalde, TX. Two types of data are useful to study and understand the phenomena of the moon’s shadow passing the Sun: changes in the pressure, temperature, density, and wind speed against the altitudes and atmosphere's layers and live video recording of the totality and the Sun's Corona. The UA team prioritized mechanical design for the payloads, engineering suitable housings for the RFD-900 (GPS transponder) and PTERODACTYL (atmospheric data collector) while considering space, weight, and durability constraints. Verification and validation were carried out to examine the robustness of 3D filament, as well as confirm code and payload function.

La Faut, James (Sophomore, Electrical Engineering, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CENTRAL ARIZONA COLLEGE – NASA ASCEND!

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Lamborn, Selena (Senior, Chemistry, ACS Comprehensive, Northern Arizona University). Mentor: Stephanie Hurst, Chemistry and Biochemistry, Northern Arizona University. [E-9]

THIN FILMS FOR USE IN QUANTUM NETWORKING: EFFECT OF P-TYPE DOPING ON SPIN COATED ITO THIN FILMS

Transparent conducting oxides (TCOs) are semiconductor materials that are commonly used in optoelectronics such as touch screen displays and solar cells. One of these TCOs, indium tin oxide (ITO) has the potential to superconduct below 4 Kelvin, which when combined with its optical properties makes it a promising material for use in quantum networking. Traditional fabrication techniques, such as electron beam deposition require large facilities and high levels of technical training. Spin-coating deposition is an alternate fabrication technique.

For this study, p-type dopants (such as sodium, lithium, and potassium ions) were added to spin-coated ITO films in quantities of 1 to 7 atom%. UV-Visible spectroscopy and ellipsometry were used to evaluate the optical properties of the films. Four-point resistance measurements were used to evaluate conductive properties. Microscopy techniques including atomic force microscopy (AFM) and scanning electron microscopy (SEM) were used to evaluate the topology of the doped ITO films.

Lang, Victoria (Senior, Applied Meteorology, Embry-Riddle Aeronautical University). Mentor: Dorothea Ivanova, Applied Aviation Sciences, Embry-Riddle Aeronautical University. [B-8]

ICE CLOUD PARAMETERIZATIONS FOR THE GLOBAL CLIMATE MODELS

Clouds are one of the largest uncertainties in the radiative budget, crucial to the understanding of the short- and long-term trends in climate. Improved parameterizations of cirrus clouds in global climate models (GCMs) require good understanding of the cloud properties and especially the role of small ice crystals in cirrus. Ice clouds play an important role in the climate system, but they are often poorly represented in climate models. The goal of this project is to help improve climate prediction through better representation of the microphysical cirrus properties in GCMs. We are creating a GCM parameterization for bimodal size spectra in mid-latitude cirrus clouds and for polar cirrus clouds. We are accomplishing this through data analysis in IDL and Python. This may also point to the different mechanisms by which convective and non-convective cirrus are generated.

Lawrence, Chance (Senior, Astronomy, Statistics and Data Science, University of Arizona). Mentor: Mike Parker, Rincon Research Corporation. [G-1]

CONTINUOUSLY INTEGRATED RASTER SCAN ALGORITHM FOR MICROWAVE ANTENNA HOLOGRAPHY

Microwave Antenna Holography is a technique employed by NASA's Deep Space Network array to detect surface imperfections on the main reflectors of their dishes. These imperfections can exponentially decrease the accuracy of data collected on these dishes at higher operational frequencies/lower wavelengths. By measuring a strong continuous wave (CW) signal from a geostationary satellite (GEO) with a main and reference antenna, an analysis of the relative phase and amplitudes of the signal can be performed to identify regions of panel misalignment, sub reflector positions, and other crucial performance factors. In the implementation of this technique, I developed a raster scan algorithm that integrates with the pre-existing antenna positioning software to create beam amplitude maps of GEO satellites. My code focused on increasing the speed of these scans by continuously integrating across the satellite's signal thereby reducing the time required for high resolution scans.

Li, Sarah (Senior, Systems Engineering, University of Arizona). Mentor: Christopher Walker, Astronomy and Steward Observatory, University of Arizona. [G-2]

CATSAT: GROUND STATION ASSEMBLY & MISSION OPERATIONS

Advancement in high-bandwidth communication technologies from SmallSats would enable progress in many science and engineering experiments and projects. The University of Arizona's CatSat, a 6U CubeSat, aims to further this goal by deploying a spherical inflatable antenna in Low Earth Orbit (LEO) for X-band communications. In preparation for launch, we are constructing ground stations for CatSat and preparing for future mission operations. CatSat's Earth stations include high data rate X-Band ground stations, as well as command and control ultra-high frequency (UHF) ground stations. The team is also learning how to define and engage in mission operations related to CatSat. This includes scheduling science operations and ground communications, creating spacecraft command scripts, and tools for processing and analysis of data collected by the spacecraft. CatSat's operational lifetime is expected to provide ample educational opportunities for the team and the community.

Limon, Melody (High School Student, Engineering, Casa Grande Union High School). Mentor: John Morris, Career and Technical Education, Casa Grande Union High School. [ASCEND-6]

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Our objective is to assess the viability of tomato seeds exposed to Mars-like conditions by sending them into the Earth's stratosphere. Our high-altitude balloon payload exposes commercially bought seeds to extreme temperatures, low pressure, UV, and beta and gamma radiation. We will compare these seeds with a control group kept in our lab. Upon return, both sets will be planted in a controlled hydroponic greenhouse. Subsequent electrophoresis tests will reveal any genetic variations. As a long-term study, we'll harvest seeds from the experimental plants for future flights, aiming to observe cumulative genetic changes over five generations. This research aims to demonstrate potential genetic mutations in tomato seeds under extreme conditions, providing insights into sustainable agriculture for future Mars colonization efforts.

Lopez Jr., Arturo (Sophomore, Aerospace Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

UARIZONA ASCEND: HIGH-ALTITUDE DATA COLLECTION WITH A CUSTOM CUBESAT PAYLOAD

CubeSats have been a rapidly growing technology over the last decade due to their diminutive total mass to orbit while maintaining spacecraft performance. However, due to their small form factor, CubeSats are extremely limited in the amount of electronics and power storage that they can carry. Within the bounds of a standard 1U CubeSat, the UArizona ASCEND payload houses an atmospheric profiling system to collect data up to 100,000 feet. The project incorporates low power considerations, volume optimization, and high durability 3D printing to improve on the University's previous ASCEND launches. The CubeSat uses durable PETG thermoplastic polyester to ensure the safety of the housing. In addition, two traditional small form factor cameras collect unique views of Earth's atmosphere throughout the ascent and descent of the payload.

Machado Jr., Juan (Sophomore, Mechanical Engineering, University of Arizona). Mentor: Hannah Budinoff, Systems and Industrial Engineering, University of Arizona. [E-4]

COMPARISON OF IN-PROCESS DISTORTION FOR METAL ADDITIVE MANUFACTURING PROCESSES USING SIMULATIONS

Additive manufacturing can create lightweight, complex structures and components. This will improve the buy-to-fly ratio allowing for more missions into space with less material waste during manufacturing and improved technical performance. Directed Energy Deposition (DED) and Laser Powder Bed Fusion (LPBF) are the two types of additive manufacturing processes that aerospace companies may use. The quality of additive parts is not yet up to par with other manufacturing methods of aerospace parts. Their thermal history caused by the manufacturing process affects the microstructure, strength, and deformation of the part. To observe the thermal history and in-process deformation, we have created process simulations for DED and LPBF using ANSYS finite element simulations. Simulations for 21 unique parts will be compared to see which process results in higher-quality parts. Results of this study can help determine whether it is better to print with LPBF or DED for a range of part geometries.

Maldonado, Jessica (Junior, Software Engineering, Northern Arizona University). Mentor: Mark McClernan, US Geological Survey. [D-11]

OPTIMIZATION OF LUNAR MAP DISTORTION

This project delves into the optimization of map projection distortion for the Artemis III lunar candidate landing sites. We investigated the feasibility of map projection optimization through the examination of three map projections: transverse Mercator, Lambert conformal conic, and oblique stereographic. Employing both manual refinement techniques used in the creation of State Plane Coordinate System zones and a dual annealing algorithms, a comparison was made in the efficiency in minimizing surface distortion. The manual implementation and algorithmic optimization, successfully achieves a low-distortion map projection for lunar use. Additionally, Python and QGIS were utilized for comparing and analyzing the manual implementation and dual annealing algorithm, examining map properties and other relevant factors to assess their effectiveness. The results concluded serve as a crucial foundation for refining low distortion map projections and enhancing geospatial data representation, ultimately advancing planetary cartography with greater accuracy and adaptability for mapping celestial bodies and much more.

Marquez, Matthew (Senior, Technological Leadership, Arizona State University). Mentor: Lance Ghavari, Herberger Institute For Design and the Arts, Arizona State University. [F-2]

EXPLORATION OF CHATGPT AS A RESEARCH TOOL FOR EXOPLANET DETECTION AND ANALYSIS

This project investigates the utilization of ChatGPT as an innovative research tool for individuals new to astronomy. The project addresses this question by having a non-expert researcher (the author) attempt to use ChatGPT to build an AI system for detecting exoplanets. Over the course of seven months, the researcher used ChatGPT for research assistance, with the goal of analyzing astronomical data with EXOTIC and AAVSO resources. The methodology employed is autoethnographic memoing, including interaction logs and a prompt catalog. The results are analyzed using an inquiry cycle framework repurposed for ChatGPT utilization. The results of the study showed that ChatGPT emerged as a potent aid in exoplanet detection, navigating EXOTIC and AAVSO datasets to identify stellar transits. However, the integration of this data with CNN models faced significant technical barriers, and ChatGPT's own limitations in domain-specific knowledge and scientific literature access highlighted the essential role of human oversight and expertise.

Mata, Anyell (Senior, Electrical Engineering, Arizona State University). Mentor: Jnaneshwar Das, School of Earth and Space Exploration, Arizona State University. [C-5]

AUTONOMOUS HIGH-ALTITUDE BALLOON PAYLOAD

The autonomous high-altitude balloon payload serves to be attached to a weather balloon and demonstrates autonomous, closed-loop feedback protocols. It is a continuation of a proof-of-concept design from NASA Space

Grant's ASCEND project at Arizona State University. There is a collective integration of reaction wheels, an open-source software platform, accessible drone equipment, and CubeSat standards. The team aims to enable new science and technology applications for researchers by designing a highly capable autonomous payload for atmospheric profiling.

Matlock, Travis (Senior, Astronomy, University of Arizona). Mentor: Lon Hood, Lunar and Planetary Laboratory, University of Arizona. [D-2]

MAPPING MARTIAN CRUSTAL MAGNETIC ANOMALIES

Unlike Earth, Mars does not sustain a global magnetic field. Instead, there are local magnetic anomalies over the most ancient crust due to remanent magnetization. Early Noachian impact basins lack these signatures, suggesting the Martian core dynamo ceased around 4.1 billion years ago. However, younger volcanic constructs are correlated with orbitally detected magnetic anomalies, implying a later cessation date. We use the full Mars Atmosphere and Volatile Evolution (MAVEN) orbital magnetometer dataset to map the crustal magnetic field from 60°S-60°N at 150 kilometers with half-degree resolution. We select orbits with periapsis altitudes less than 170 kilometers, discarding orbits with evidence of ionospheric disturbances, and model the data using an equivalent source dipole method. We produce a near-global map and examine anomalies near Hadriaca Patera, Apollinaris Patera, and Claritas Fossae. The anomalies at Claritas Fossae correlate closely with topographic and geologic features. This has not yet been reported in the literature.

Mattison, Kane (First-Year, Aerospace Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

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Maziarka, Elizabeth (First-Year, Engineering Pathway, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CAC BETA X

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Mazziotti, Nicolas (Junior, Astronomy, Physics, University of Arizona). Mentor: David Sand, Astronomy, University of Arizona. [A-26]

UTILIZING CITIZEN SCIENCE TO IDENTIFY DIFFUSE GALAXIES

Diffuse galaxies are challenging to identify because of their extended sizes and low surface brightness, often appearing as faint "smudges" in optical images. While diffuse galaxy catalogs can be reliably constructed through visual inspection, this method quickly becomes time-consuming for large-area surveys. In this project, we aim to construct a visual catalog of diffuse galaxies in the Fornax galaxy cluster through Zooniverse, a popular citizen science platform. With the help of over 1000 volunteers, we identified >50 diffuse galaxies not found by existing automated searches of Fornax and four candidates that were previously entirely unknown. We further investigate the parameter space where our visual classifications outperform automated detection methods, as well as trends in the distribution of diffuse galaxies with a nuclear star cluster. Even as machine learning algorithms progress, citizen science will remain a valuable tool for verifying the reliability and completeness of automated searches over large-area surveys.

McLendon, Xander (Senior, Mechanical Engineering, Embry-Riddle Aeronautical University). Mentor: Pragati Pradhan, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-5]

ULTRA COMPACT X-RAY BINARY SYSTEMS

Ultracompact X-ray binary systems are a rare type of low mass X-ray binary system consisting of a low mass donor star and an accretor, which is typically a neutron star or black hole. The donor star transfers mass to the accretor, forming an accretion disk that contains the heated gases of the donor star. These heated gases are responsible for emitting the X-rays as they become accelerated through the accretion disk. Ultracompact X-ray binary systems are characterized as having relatively short orbital periods, usually less than an hour. The goal of this project is to examine the mass transfer between donor and accretor for several UCXB systems. The overarching drive behind this project questions how mass transfer varies with orbital period and mass ratio between the compact objects, and how accurate are current models for UCXB mass transfer parameters.

McLeod, Noah (Junior, Astrophysics, Arizona State University). Mentor: Timothy Carleton, School of Earth and Space Exploration, Arizona State University. [A-8]

GALAXY MORPHOLOGY OF PEARLSDG

Galaxy Morphology can be used to understand galaxy formation and evolution. PEARLSDG is an extremely isolated quiescent dwarf galaxy with a remarkably low star formation rate (Carleton et al, 2023). We aim to establish morphological parameters on PEARLSDG and compare them with other dwarf galaxies. By studying its morphology in detail, we hope to gain insight as to whether its unusual properties were the result of internal or external mechanisms. We used Statmorph to calculate these morphological parameters of PEARLDG. We obtained concentration, asymmetry, and smoothness (CAS) statistics to examine the morphology of PEARLSDG. We found these statistics for all 6 JWST filters and estimated PEARLSDG to have an average asymmetry of approximately 0.13, a value consistent with other dwarf galaxies. Though PEARLSDG is quite isolated, its morphology could indicate past interaction and hint at the existence of dark matter which could be causing this asymmetry.

Meagher, Breck (Senior, Space Physics, Embry-Riddle Aeronautical University). Mentor: John Pavlina, Electrical, Computer, and Software Engineering Department, Embry-Riddle Aeronautical University. [E-10]

BATHYMETRIC LIDAR: INVESTIGATION OF OPTIMAL VISIBLE LIGHT FOR NON-IDEAL AQUATIC ENVIRONMENTS

The purity of water is a critical factor in various industrial applications, including Bathymetric LiDAR; which relies on the transmission and reception of laser beams through water to capture underwater topography. Water quality can affect the performance of LiDAR systems, as impurities and suspended particles lead to light attenuation, impacting the accuracy and detail of the data. The project's objective is to investigate the relationship between water purity and its effects on visible light spectrum lasers, focusing on light attenuation methods and quantitatively identifying the optimal visible light laser for Bathymetric LiDAR. Accurate and detailed underwater mapping relates to fields in defense, security, and space exploration, which includes: submarine navigation, harbor security, and potentially moon subsurface water exploration and mapping. By analyzing impure water on laser performance, we enhance the accuracy and reliability of LiDAR systems in complex settings and contribute to stronger security and new pathways of space exploration.

Mendoza, Jose (First-Year, Software Development, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CAC BETA X

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Miller, Megan (Sophomore, Astrophysics, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [NEBP-5]

STRATOSPHERIC STORIES: ARIZONA ECLIPSE HIGH ALTITUDE BALLOONING

The Arizona Eclipse Ballooning Project is a collaborative effort involving teams across Arizona with the aim of launching high-altitude balloons during the October 14th, 2023, Annular Solar Eclipse and the April 8th, 2024, Total Solar Eclipse. The data was obtained from the Payload To Enable Retrieval Of Data And Communication Telemetry While Lofted (PTERODACTYL), encompasses both annular and total solar eclipses. Our balloons traverse through the troposphere, tropopause, and stratosphere during these launches. The collected data not only sheds light on changes in the ozone layer but also elucidates the effects of altitude on pressure, temperature, and vertical velocity of high-altitude balloons. Additionally, analysis of vertical velocity data may provide insights into the presence of gravity waves within the atmosphere during the eclipse.

Miller, Clyde (Junior, Mechanical Engineering (Propulsion), Embry-Riddle Aeronautical University). Mentor: Pragati Pradhan, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-5]

MASS TRANSFER ANALYSIS OF ULTRACOMPACT X-RAY BINARY SYSTEMS

Ultracompact X-ray binary systems are a rare type of low mass X-ray binary system consisting of a low mass donor star and an accretor, which is typically a neutron star or black hole. The donor star transfers mass to the accretor, forming an accretion disk that contains the heated gases of the donor star. These heated gases are responsible for emitting the X-rays as they become accelerated through the accretion disk. Ultracompact X-ray binary systems are characterized as having relatively short orbital periods, usually less than an hour. The goal of this project is to examine the mass transfer between donor and accretor for several UCXB systems. The overarching drive behind this project questions how mass transfer varies with orbital period and mass ratio between the compact objects, and how accurate are current models for UCXB mass transfer parameters.

Montano, Sebastian (Senior, Astrophysics, Arizona State University). Mentor: Allison Noble, School of Earth and Space Exploration, Arizona State University. [A-11]

DUST CONTINUUM ANALYSIS OF DISTANT GALAXIES THROUGH SIMULATIONS OF ALMA OBSERVATIONS

Throughout the universe's history, galaxies have undergone several evolutionary stages, from early periods of immense star formation to later periods of dormancy. To better understand these galactic environments, I am focusing on the thermal dust emission in galaxies from 10 billion years ago. In particular, I generate simulations of thermal dust emission through the Common Astronomy Software Application (CASA) and data from the Atacama Large Millimeter / Submillimeter Array (ALMA). These simulations will ultimately be used to blindly measure and assess the dust emission size of galaxies based on the signal-to-noise in the image. Thus far, I have been able to generate a suite of model thermal dust emissions of galaxies with varying sizes and flux values, all of which will be tested to understand how the relative signal-to-noise ratios affect the accuracy of the size measurements. In future work, I plan to expand the parameter space for these models.

Moore, Everett (Junior, Aerospace Engineering, Astrophysics, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [NEBP-5]

ARIZONA ECLIPSE BALLOONING PROJECT

The AZ South team comprises ASU, UA, GCC, and CGUHS. Our main goal is to analyze atmospheric data between 70,000 to 85,000 feet during the 10/14/23 Annular Solar Eclipse in Roswell, NM, and the 04/08/24 Total Solar Eclipse in Uvalde, TX. Two types of data are useful to study and understand the phenomena of the moon's shadow passing the Sun: (1) changes in pressure, temperature, density, and wind speed against the altitudes and atmosphere's layers and (2) live video recording of the totality and the Sun's corona.

All of the sensors that are launched with the weather balloon need their own payload housings. Through the use of engineering and design innovation, 3D printed payloads have been designed, tested, and launched to successfully protect the sensors needed to collect data during the eclipses.

Moore, Shannon (Junior, Space Physics, Embry-Riddle Aeronautical University). Mentor: Noel Richardson, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-9]

ANALYZING THE VARIABILITY AND ORBIT OF MASSIVE BINARY ETA CARINAE

Eta Carinae is an usually massive, highly eccentric Luminous Blue Variable (LBV) star with intense, periodic peaks in its brightness and astrophysicists have yet to find out why. We aim to more clearly and accurately describe the kinematics of the system's orbit and model the forces influencing its luminosity, ultimately providing the astrophysical community with information regarding the highly eccentric Eta Carinae system. To study this variable behavior, we are analyzing seven years of photometric data from the BRITE (BRIght Target Explorer) Constellation mission and modeling Tidally Excited Oscillations. Additionally, we are expanding on the study of Eta Carinae's orbit by analyzing new emission lines from the system. Further analysis of elemental emission lines could better constrain Eta Carinae's orbit and provide key information in the effort to explain the system's past, current, and future behaviors.

Morgan, Ethan (High School Student, Software and App Design, Casa Grande Union High School). Mentor: John Morris, Carrer and Technical Education, Casa Grande Union High School. [ASCEND-6]

EXPLORING THE MARTIAN AGRICULTURE FRONTIER: ASSESSING TOMATO ADAPTABILITY THROUGH HIGH ALTITUDE EXPERIMENTATION

Our objective is to assess the viability of tomato seeds exposed to Mars-like conditions by sending them into the Earth's stratosphere. Our high-altitude balloon payload exposes commercially bought seeds to extreme temperatures, low pressure, UV, and beta and gamma radiation. We will compare these seeds with a control group kept in our lab. Upon return, both sets will be planted in a controlled hydroponic greenhouse. Subsequent electrophoresis tests will reveal any genetic variations. As a long-term study, we'll harvest seeds from the experimental plants for future flights, aiming to observe cumulative genetic changes over five generations. This research aims to demonstrate potential genetic mutations in tomato seeds under extreme conditions, providing insights into sustainable agriculture for future Mars colonization efforts.

Morris, Grace (Senior, Mechanical Engineering, Northern Arizona University). Mentor: Subhayan De, Mechanical Engineering, Northern Arizona University. [E-12]

DEVELOPMENT OF MACHINE LEARNING ASSISTED SURROGATE MODELS FOR COMPLEX SPACE STRUCTURES

Complex space structures, like the ISS, have several components, including trusses, solar panels, pressurized experimental modules, and docking ports. These components show complicated behavior due to nonlinear joint stiffnesses, large deformation, viscoelastic and elastoplastic properties of the solar arrays, slippage in the docking system, and the ubiquitous presence of uncertainty in material properties, and loading. However, surrogate models and various machine-learning tools can be used to represent these structures in a computationally efficient manner. A finite element model of the outermost solar panels and P3/4 truss assembly was generated in SolidWorks using a blender model. ANSYS was used to perform the dynamic analysis of the structure for multiple realizations of uncertainty in the material properties. The resulting dataset consisting of natural frequencies and mode shapes was then used to train a Bayesian Neural Network and Variational Autoencoder, two artificial neural network architectures with inherent capability to represent the underlying uncertainty.

Morton, Lucienne (Sophomore, Geology, Northern Arizona University). Mentor: Timothy Titus, USGS Astrogeology Science Center, US Geological Survey. [D-3]

POST-MID-SIZE ASTEROID IMPACT LONG-TERM FLOODING HAZARDS

Flooding is one of the possible long-term cascading effects of a mid-sized asteroid impact. Post-impact, the thermally radiated soils result in a hydrophobic area where increased rainfall runoff occurs, raising the risk of flooding. This project seeks to understand how sensitive the number of people affected is from post-impact flooding based on the thermally radiated hydrophobic radius. GeoCLAW, a shallow water equation-solving program, was used to estimate water depth. This model output was applied to a population map, producing a total affected population across all river basins based on a range of hydrophobic radii and climate scenarios. The size of the hydrophobic radius, the number of river basins involved, and the locations of population centers were found to be the major factors influencing the total affected population. These findings suggest that the long-term flooding hazards associated with asteroid impacts are significant and relevant to the planetary defense conversation.

Mountz, Elijah (High School Student, Software Programming, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CAC BETA X

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Navarro, Roberto (Sophomore, Aerospace Engineering, Pima Community College). Mentors: AnnMarie Condes and Ross Waldrip, Science and Engineering, Pima Community College. [ASCEND-11]

EXTRATERRESTRIAL SOLAR POWER AND HYDRO CRYSTALLINE STRUCTURES

Atmospheric research plays a key role in understanding the environment. Technologies including solar panels, form the backbone of the future of clean energy on earth and understanding how to optimize their power output is critical. The study of water and its uses yields new applications for industry use including engineering and manufacturing. This research was conducted using a cubic satellite payload modeled after NASA's CubeSat design. The three separate chambers contain the electronics and power sources, the camera optics, digital logic circuits, and the water substance with a fixed optical magnification device. The payload was sent to the stratosphere to capture data on various aspects of the structure of water and factors affecting the power output of an array of solar panels including ambient light, temperature, altitude, and radiation. This research will aid in the optimization of solar panel operation and further understanding the behavior of water under different conditions.

Nayyar, Veer (Junior, Mechanical Engineering, University of Arizona). Mentors: Alex Craig and Brian Kinsey, Aerospace and Mechanical Engineering, University of Arizona. [C-3]

FLOW TEMPERATURE CHARACTERIZATION OF A MACH 5 WIND TUNNEL

Obtaining a greater understanding of high-speed compressible flows has drastic implications for both commercial and defense aviation, as well as space access technology. The total (or stagnation) temperature in wind tunnel experiments directly affects the characteristics of viscous flow interactions with experimental models. To characterize the flow temperature of the Boundary Layer Stability and Transition Laboratory's Mach 5 Ludwieg Tube, a purpose-built stagnation temperature probe was designed and manufactured. The probe consists of an Ahmic thin-film platinum resistance thermometer housed in a rigid 3D-printed casing, shielded by a stainless steel chamber. To ensure accurate measurements, the probe was preheated to the anticipated temperature before the tunnel was activated. Adjustable aluminum mounting hardware assemblies were designed and manufactured, allowing total temperature to be measured in conjunction with other experiments. The incorporation of an adaptable stagnation temperature probe into wind tunnel experiments therefore expands understanding of flow interactions with various model configurations.

Negrao, Gabriel (Senior, Chemical Engineering, Arizona State University). Mentor: Jean Andino, School for Engineering of Matter, Transport and Energy, Arizona State University. [G-7]

3-D PRINTED AFTERGLOW FILTERS FOR AIR POLLUTION CONTROL

The rapid development of Direct Ink Written (DIW) technology over the past several years has allowed advancements in almost every engineering discipline. By utilizing the design flexibility that this method has provided, The Andino Research group has pioneered the development of ZnS:Cu-based photocatalytic DIW monolith air filters, which utilize a blue phosphor compound to enable an afterglow effect. This luminescence was found to extend for a significant time after the end of UV light exposure, allowing the photocatalytic reaction occurring on the surface of the monoliths to be much more energy efficient. Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS) was used to analyze the DIW structures on a molecular level. Comparisons of ZnS:Cu and ZnS:Cu DRIFTS readings verified successful copper doping into the ZnS matrix. Additionally, spectra collected before and after exposure to the gas of interest provided insight into the performance of the adsorbents that were created.

Newlin, Kyle (Senior, Aerospace Engineering, Embry-Riddle Aeronautical University). Mentor: Davide Conte, Aerospace Engineering, Embry-Riddle Aeronautical University. [G-9]

TRAJECTORY OPTIMIZATION FOR SHUTTLE VIA EARTH-MARS CYCLER ORBIT

NASA and other space-faring organizations have long expressed hopes of developing a sustainable mission sequence to deliver crew and cargo to Mars. The Aldrin cycler, a namesake of the famous astronaut, suggests a trajectory capable of continually revisiting Earth and Mars. This trajectory relies on a single burn followed by successive gravity assists from Earth. However, the basic form of this trajectory makes notable simplifications to the Solar System's geometry, and restricts practical application. This project aims to leverage orbital mechanics, numerical methods, state-of-the-art planetary data, and heuristic optimization schemes to develop a range of possible cycler trajectories. Our current optimization structure, when applied to free return trajectories, yields ΔV's of ~4 km/s, well on par with established optimums. With further tuning, our goal is to apply these schemes to Earth-Mars cyclers and tailor them to meet potential mission requirements.

Nielsen, Tyler (Junior, Computer Systems Engineering, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [ASCEND-4]

ANALYSIS OF EXTRATERRESTRIAL RADIATION'S IMPACT ON OZONE AND ITS IMPLICATIONS FOR CLIMATE AND HEALTH ON A HIGH-ALTITUDE BALLOONING PAYLOAD

The purpose of the ASCEND flights are to complete various Meteorology science missions. In Fall 2023, the meteorological mission used pressure, internal and external temperature, GPS, and accelerometer to monitor barometric pressure in relation to the storm system passing through Arizona during that launch. In Spring 2024, ASCEND used a UV sensor and Geiger-Müller tube to explore the link between solar wind radiation, UVB radiation, and ozone layer dynamics. Post-flight, correlations between radiation levels and ozone layer effects were analyzed in order to determine extraterrestrial radiation's impact on ozone and its implications for climate and health. Concurrently, the mission's flight software underwent a redesign, adopting an object-oriented paradigm (OOP) to enhance scalability and risk mitigation while a reusable design for the printed circuit board (PCB) was implemented. Overall, ASCEND created an advanced payload capable of withstanding a flight in the atmosphere and impact landing, while keeping its contacts intact.

Nordmeyer, Garret (Post-Baccalaureate, Engineering, Robotics, Phoenix College). Mentor: Eddie Ong, Physical Sciences, Phoenix College. [ASCEND-10]

ENHANCING LAUNCH DYNAMICS: INTEGRATING SENSORS AND STABILIZATION FOR ADVANCED ATMOSPHERIC ANALYSIS

The Phoenix College NASA ASCEND team has maintained a longstanding engagement in launch activities. Our focus revolves around enhancing fabrication techniques and standardization protocols for components within our carbon fiber reinforced vehicle. Integration of sensors for light experiments is underway to facilitate altitude-dependent measurements and to capture behavioral data of the vehicle during launch sequences. Notably, for the Spring 2024 launch, our endeavors extend to deploying two Geiger counters: one for beta and gamma radiation assessment across altitudinal gradients, with the other aimed at neutron detection at varying elevations to ascertain the Pfotzer–Regener maximum. Concurrently, efforts are directed towards refining stabilization of captured videos, with the incorporation of an upward-looking camera for enhanced observation. Additionally, a pre-launch cooling mechanism has been devised and implemented to optimize vehicle performance.

Nova, Sola (Sophomore, Astronomy, Embry-Riddle Aeronautical University). Mentor: Noel Richardson, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-24]

BE STARS: LAMBDA PAVONIS

Be stars are class B stars with broad emission lines. They emit gaseous materials forming a disk around the star and our research aims to answer what is responsible for disk formation. The current objective is to find any periodic phenomena that may be responsible, done primarily with Time Series Analysis (TSA), Fourier Analysis, and spectroscopic changes in the stars. Currently, we have spectra depicting when outbursts occurred, and we have some TSA suggesting the period for disk formation is about one day. We're currently working on the Fourier Analysis to find periodicity in stellar brightness, which with the spectra can then reveal if periodic phenomena are responsible for disk formation. At this stage, we know when the star had a disk present and roughly how it behaves in time. When Fourier Analysis is completed, we'll be one step closer to understanding why these types of stars build disks.

Okafor, Nathaniel (First-Year, Network and System Administration, Phoenix College). Mentor: Eddie Ong, Physical Sciences, Phoenix College. [ASCEND-10]

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Ontiveros, Ricardo (Junior, Electrical Engineering, Arizona State University). Mentor: Tom Sharp, School of Earth and Space Exploration, Arizona State University. [ASCEND-4]

ANALYSIS OF EXTRATERRESTRIAL RADIATION'S IMPACT ON OZONE AND ITS IMPLICATIONS FOR CLIMATE AND HEALTH ON A HIGH-ALTITUDE BALLOONING PAYLOAD

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Oppen, Ryan (Junior, Aerospace Engineering, Arizona State University). Mentor: Timothy Takahashi, School for Engineering of Matter, Transport, and Energy, Arizona State University. [C-1]

DESIGN OF ACTUATED SYSTEMS FOR FLYING MACHINES

The objective of this research is to leverage my background knowledge and experience with robotics to learn to and practice building actuated systems on flying machines. These systems will be used in the design of a competition plane for the AIAA Design Build Fly competition. One can begin by learning the type and magnitudes of steady state loads experienced, namely pressure fields. From there, unsteady loads such as turbulence, vibrations, and cavity resonance. Having knowledge of both steady and unsteady loads allows for the general loads, meaning forces and torques, on specific mechanisms or structures to be determined. The proper sizing of actuators and any necessary mechanism components can be chosen to account for such loading, including a reasonable factor of safety. With this choice comes the proper testing and analysis of each system, ensuring a successful mission during competition.

Ortiz, Rafael (Senior, Astrophysics, Arizona State University). Mentor: Rogier Windhorst, School of Earth and Space Exploration, Arizona State University. [A-21]

PEARLS: DISCOVERY OF INTERMEDIATE REDSHIFT SEYFERT-LIKE GALAXIES WITH UNIQUE PSF-FEATURES IN THEIR CORES THROUGHOUT THE NORTH ECLIPTIC POLE TIME DOMAIN FIELD

We visually identified a sample of 66 galaxies (~ 1 galaxy/arcmin^2), for each of which we fit the SED to infer the AGN and host galaxy components. We used an AGN SED library to best fit 70% of our sample with a Seyfert-blended SED. We find that 56% of galaxies show characteristics of a starburst while the remainder exist near their respective star-formation main sequence. We find the sample's median fractional AGN contribution $\sim 0.30 \pm 0.06$ compared to the bolometric luminosity integrated from 0.1-30.0µm. Additionally, we position match our sample with VLA 3 GHz detections and identify 24 galaxies with radio counterparts within 0.5”. Finally, we present a novel concentration measure based on the compactness of objects’ light profiles at 4.4µm that effectively isolates our sample from stars, and automatically recovers our visual sample. We discuss how we resurrect a classical approach that probes AGN presence via galaxy morphology.

Owens, Norma (Sophomore, Agricultural Business, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CENTRAL ARIZONA COLLEGE – NASA ASCEND!

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Parrish, Alexis-Marie (Junior, Environmental Science, Alabama Agricultural and Mechanical University). Mentor: David Holbrook, Department of Energy, Office of Legacy Management. [B-6]

Vegetation Monitoring at LM Sites

The Department of Energy's Legacy Management (DOE-LM) oversees the safe disposal of uranium through specialized cells designed to contain and isolate radioactive waste, ensuring long-term environmental protection. Vegetation can affect the performance of DOE-LM disposal cells, with effects varying from detrimental to advantageous depending on factors like cover design and environmental considerations. LM manages vegetation because plants can influence radon diffusion, erosion, and percolation of precipitation. Furthermore, LM aims to harness natural processes, such as plant succession and revegetation techniques, to promote a long-term, sustainable management approach. LM monitors changes in vegetation by employing techniques like line-point intercept, Daubenmire quadrats, and leaf area index. Additionally, LM's vegetation monitoring can be a blueprint for organic crop production, such as cotton, hemp, and bamboo, by matching appropriate monitoring techniques with local environmental conditions. This adaptive approach enables LM to address evolving challenges effectively while maximizing the long-term benefits of vegetation management.

Pillon, Brandon (Junior, Space Physics, Embry-Riddle Aeronautical University). Mentor: Michelle Zanolin, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-1]

Noise Reduction in Low Frequency LIGO Detectors

The objective is looking into how to improve the detection capabilities of low-frequency gravitational waves. The current generation of gravitational wave detectors is not focused on the low-frequency end of the spectrum, and this project aims to study the low frequency noise so that a detector can be made more effective. Another aspect of this project will be to build a functional representation of the LIGO mirrors to learn about their natural frequencies and how to mitigate the low frequency noise due to these natural frequencies. Since the noise most common in the LIGO interferometer is in the low-frequency range, the same range as low-frequency gravitational waves, reducing the noise will allow LIGO to detect these gravitational waves.

Polk, David (Senior, Electrical and Computer Engineering, University of Arizona). Mentor: Kenneth Johns, Physics, University of Arizona. [A-16]

Calibrating the ATLAS Calorimeter using Single Particle Interactions with Machine Learning

One of the principal detectors in the ATLAS experiment at the CERN Large Hadron Collider is the Liquid Argon Calorimeter. Particles produced in proton-proton collisions deposit energy in the calorimeter and are reconstructed as topologically connected clusters. To use these clusters for physics, they must be calibrated so that their measured energy is close to their true energy. Machine learning has been used in the past to successfully calibrate clusters associated with jets. This project investigates the question whether clusters from single particle interactions can be used to calibrate clusters that are produced from jets. Deep neural networks (DNN) were used for this study to predict the amount of energy deposited by particles. We obtained more accurate calibration results for single particles than current methods when training with clusters from single particles. The calibration results for clusters from jets showed a poorer performance when training with clusters for single particles.

Pujary, Vaidehi (Junior, Electrical and Computer Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [NEBP-5]

Arizona South NEBP Team

The AZ South team comprises ASU, UA, and CGUHS. Our main goal is to collect and analyze high-altitude data between 70,000 to 85,000 feet during the 2023 Annular Solar Eclipse in Roswell, NM, and the 2024 Total Solar Eclipse in Uvalde, TX. Two types of data are useful to study and understand the phenomena of the moon's shadow passing the Sun: changes in the pressure, temperature, density, and wind speed against the altitudes and atmosphere's layers and live video recording of the totality and the Sun's Corona. The UA team prioritized mechanical design for the payloads, engineering suitable housings for the RFD-900 (GPS transponder) and PTERODACTYL (atmospheric data collector) while considering space, weight, and durability constraints. Verification and validation were carried out to examine the robustness of 3D filament, as well as confirm code and payload function.

Quirk, Colton (Junior, Physics, Astronomy, University of Arizona). Mentor: Haeun Chung, Astronomy and Steward Observatory, University of Arizona. [A-18]

ANALYZING ARCHIVAL FIMS/SPEAR DATA TO CONSTRUCT A FAR-ULTRAVIOLET BACKGROUND MAP

Observations reveal ultraviolet (UV) background radiation levels surpass those predicted by known UV-emitting processes, posing a challenge for astrophysics. Our study used FIMS/SPEAR data to construct an accurate far ultraviolet (FUV) background map, noting higher UV radiation levels potentially linked to Lyman-beta emission line scattering. We developed a data analysis pipeline to correct this excess light by identifying a correlation between pixel intensity and the Lyman-beta line, allowing us to adjust the FUV background more accurately. Our findings refine the measurement of UV background radiation, emphasizing the need to account for scattering effects in space-based observations. This work enhances our understanding of the UV background and advocates for future missions to measure UV background radiation with greater sensitivity than what FIMS/SPEAR could achieve.

Qureshi, Ahmad (Sophomore, Electrical and Computer Engineering, University of Arizona). Mentor: Naomi Yescas, Lunar and Planetary Laboratory, University of Arizona. [A-17]

DIGITAL ANALYSIS OF IONOSPHERIC PLASMA ON-BOARD WAVES, INSTABILITIES & NOISE SPECTROMETER (WINS)

The Waves, Instabilities & Noise Spectrometer (WINS) instrument, to be deployed on a CubeSat, is designed to delve into the intricacies of the ionosphere by collecting and analyzing electrostatic waves. The device uses Analog Digital Converters on a custom Printed Circuit Board with a 64 Megasample/second rate to collect samples quickly enough for relevant waves throughout the E and F layers of the ionosphere. The output will then pass through a custom Fast Fourier Transform created to complete the analysis accurately in the frequency range between 32 kHz and Nyquist frequency of 32 MHz. Our work is focused on analyzing and understanding the waves after the digital conversion is complete. Using my Field Programmable Gate Array design on an Application Specific Integrated Circuit, we intend to analyze the waves entirely onboard. We anticipate that observations from this instrument will greatly contribute to understanding interactions between the magnetosphere, ionosphere, and atmosphere.

Rahmer, Walter (Senior, Optical Sciences and Engineering, University of Arizona). Mentor: Christopher Walker, Astronomy and Steward Observatory, University of Arizona. [G-3]

CATSAT: PREPARING FOR CUBESAT FLIGHT OPERATIONS AND SCIENCE

CatSat is a technology demonstration and scientific research satellite designed and built primarily by students at the University of Arizona in partnership with two Tucson companies; FreeFall Aerospace and Rincon Research. Currently small satellites are limited in data transmission capabilities due to their reliance on compact antennas with very limited gain. CatSat carries a novel, inflatable, high-gain antenna that will enable a high-speed communications link while achieving a small stow volume for launch. The science payload onboard includes a high-definition camera for Earth imaging and a high frequency (HF) receiver system designed to probe the Earth's ionosphere during twilight by capturing and analyzing multi-frequency signals sent by ground based amateur radio operators. The spacecraft has been fully built and qualified for launch. Recent efforts by the team have been focused on setting up ground control infrastructure and planning for operations in flight.

Ramirez, Elijah (Senior, Mechanical Engineering, Casa Grande Union High School). Mentor: John Morris, Carrer and Technical Education, Casa Grande Union High School. [ASCEND-6]

EXPLORING THE MARTIAN AGRICULTURE FRONTIER: ASSESSING TOMATO ADAPTABILITY THROUGH HIGH ALTITUDE EXPERIMENTATION

Our objective is to assess the viability of tomato seeds exposed to Mars-like conditions by sending them into the Earth’s stratosphere. Our high-altitude balloon payload exposes commercially bought seeds to extreme temperatures, low pressure, UV, and beta and gamma radiation. We will compare these seeds with a control group kept in our lab. Upon return, both sets will be planted in a controlled hydroponic greenhouse. Subsequent electrophoresis tests will reveal any genetic variations. As a long-term study, we'll harvest seeds from the experimental plants for future flights, aiming to observe cumulative genetic changes over five generations. This research aims to demonstrate potential genetic mutations in tomato seeds under extreme conditions, providing insights into sustainable agriculture for future Mars colonization efforts.

Reed, Chloe (Senior, Aerospace Engineering, Embry-Riddle Aeronautical University). Mentor: Yabin Liao, Aerospace Engineering, Embry-Riddle Aeronautical University. [ASCEND-2]

LONG-DISTANCE VIDEO AND TELEMETRY STREAMING

This project involves testing the performance of a radio 2.4GHz as well as sensor data. The payload, attached to a high-altitude balloon, will transmit live video and telemetry over the 2.4GHz frequency. The signals will be received with high-gain antennas on a tracking ground station, and the onboard SD card will collect the same telemetry data for comparison purposes. Additionally, a microcontroller (Adafruit feather STM32405) equipped with sensors will be used to determine the location of the payload in 3D space and its orientation. The sensors used for data collection include a UV light sensor, spectrograph, IMU, barometer, GPS, and a Geiger counter. The project's goal is to characterize the quality and range of these 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.

Reyes Villa, Alejandro (Senior, Aerospace Engineering, Glendale Community College). Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College. [ASCEND-7]

GCC ASCEND, TEAM ICARUS: TESTING NEW DIGITAL SENSORS AND DETECTING UV LIGHT

During the fall semester, the ASCEND teams at GCC designed and built payloads that were attached to a high-altitude weather balloon, which rose to over 100,000ft. These payloads successfully measured temperature, pressure, and acceleration with analog sensors, while also recording video throughout the flight. Starting with this basic design, during the spring semester our team also measured ultraviolet light and used two new I 2 C digital sensors; one was a three-axis accelerometer and gyroscope, while the other measured temperature and pressure. Including these new digital sensors allowed for a direct comparison between the data collected with analog and digital sensors. The payload also included a GPS sensor and an Iridium modem to transmit data via satellites every 5 minutes. This allowed our team to track the payload’s path during its flight independent of the GPS information provided by ANSR, while also correlating the data collected with the payload’s altitude.

Rhomberg, Rachel (Junior, Aerospace Engineering, University of Arizona). Mentor: James Threadgill, Aerospace and Mechanical Engineering, University of Arizona. [G-8]

PNEUMATIC SYSTEM INTEGRATION IN SUPERSONIC FLOW

Many flight systems employ high pressure jets to enhance control authority and efficiency of aerodynamic vehicles. This study involves analyzing the dynamic characterization of transverse jets within a supersonic wind tunnel, aiming to highlight their effects on flow behavior. The primary objective of this research is to understand flow alterations induced by supersonic transverse jets to increase knowledge of the fundamental principles governing aerodynamic control. To ensure the jet nozzle is producing flow with the correct expected velocity profile, pressure transducer measurements were taken. Density based optical diagnostics (Schlieren visualization) were used to analyze the flow patterns surrounding the transverse jets, examining phenomena such as shock wave interactions and boundary layer effects. This study provides insight into flow dynamics crucial for optimizing pneumatic systems in supersonic environments, offering valuable contributions to the advancement of aerospace technology.

Robertson, Katrina (Senior, Mechanical Engineering, Embry-Riddle Aeronautical University). Mentor: Johnathan Adams, Humanities and Communications, Embry-Riddle Aeronautical University. [F-6]

BRIDGES TO BELONGING

Students in introductory engineering courses face challenges communicating their ideas fairly and equally during work in team projects. Often, these challenges with team communication fall along gendered lines, where women experience marginalization in team settings that decreases their sense of belonging in the engineering program. The research here presents the results from an educational intervention wherein students were assigned to complete a mock design-build-test activity while researchers were present to make observational notes. The notes and survey data collected from the participating students were then used to structure teams within the classrooms for the remainder of the semester. This intervention was shown to alleviate some of the gendered issues typically seen in the early engineering classroom. The results of this intervention provide insight into the possible impacts that low-scale implementations can have on the engineering classroom to support a diverse and inclusive environment.

Rodriguez, Jose (Sophomore, Mechanical Engineering, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CENTRAL ARIZONA COLLEGE – NASA ASCEND!

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Romero, Areli (Sophomore, Engineering, Arizona Western College). Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma. [ASCEND-9]

EXPLORING ATMOSPHERIC DYNAMICS: A COLLABORATIVE ENDEAVOR IN AIR QUALITY RESEARCH

This project is a collaboration between Arizona Western College, University of Arizona-Yuma, and Arizona State University Online on a first payload from the Western Engineering Science and Technology (WEST) Club. Students decided to investigate air quality as a function of altitude. For this first iteration, students determined that it would be practical to concentrate on retrieving data from one sensor and the payload's structure. With the data collected on temperature, pressure, and altitude, we can discern the correlation between temperature and pressure with varying altitudes. The team split into two groups: hardware/software and structural. The hardware/software team used Arduino hardware and coding alongside a microSD card. Meanwhile, the structural team used a junction box and Styrofoam, among other materials, to create the payload. This experience helped students learn how their courses are applied to real-world engineering projects while conducting research that could benefit humanity.

Roulston, Winona (Senior, Mechanical Engineering, Embry-Riddle Aeronautical University). Mentor: David Lanning, Aerospace Engineering, Embry-Riddle Aeronautical University. [E-1]

INVESTIGATION OF STRESS CONCENTRATIONS IN FUSED DEPOSITION MODELED PARTS

Fused Deposition Modeling (FDM), an additive manufacturing process, has an increasing presence within industry. However, there is a lack in knowledge about process parameters that affect the quality and mechanical properties of FDM parts. To investigate these effects, the infill is constrained to a 'gyroid' pattern, and density varies at 20%, 40%, and 60%. Previous investigations have resulted in non-intuitive results that contradict traditional solid mechanic theories. Stress-inducing "v" notches and elliptical holes are compared to previously tested specimens with circular holes and semi-circular stress concentrations. While the theoretical stress concentration factor can be designed to be the same between a "v" and semi-circular notch, the stress field around the notch varies with a higher maximum stress at the "v" notch due to the sharp curve. This leads to higher probability of crack initiation and propagation than traditionally expected, which will be influential in creating failure theories for 3D-printed products.

Ruddick, Logan (Senior, Aerospace Engineering, Astronautics, Embry-Riddle Aeronautical University). Mentor: Ahmed Sulyman, Department of Computer, Electrical, and Software Engineering, Embry-Riddle Aeronautical University. [F-1]

PROJECT MANAGEMENT PRACTICES FOR UNDERGRADUATE SPACE PROJECTS

Undergraduate STEM and research projects can be large and complex, sometimes spanning multiple months to years and using upwards with hundreds of thousands of dollars. Pure engineering and technical skill are no longer sufficient in these projects to ensure they stay on track in both time and budget. Common project management tools and techniques for schedule, stakeholder, and resource/personnel management can be deployed by team leadership to improve the efficiency of the team and mitigate project failure points. Implementing project management practices on the Embry-Riddle Aeronautical University EagleSat-2 team has shown to be highly effective for driving the project forward and successfully meeting deadlines for test readiness. Learning to implement project management tools and practices can benefit any project in keeping an accurate timeline and orchestrating resources in accomplishing technical tasks.

Saavedra, Sarah (Sophomore, Earth and Space Exploration (Astrophysics), Arizona State University). Mentor: Allison Noble, School of Earth and Space Exploration, Arizona State University. [A-14]

ANALYZING DUST IN DISTANT GALAXIES

Understanding the influence of the cosmic environment on galaxy evolution is a key goal in astrophysics, an understanding furthered by comparing the sizes of stellar, gas, and dust components of galaxies. I measure and analyze the size of cluster galaxies' dust emissions at 350 GHz, observed with the Atacama Large Millimeter Array. I fit each source with a 2D Gaussian in the Common Astronomy Software Application (CASA) that enables me to record the best fit. For each galaxy, I use six different methods to determine the most precise measurement technique based on the image's noise level and the size of the angular resolution. Thus far, five of the six methods have yielded consistent results, and I will proceed with the best of the six. After testing this method's accuracy further via simulations that mimic actual observations, I will expand my data set to include different components of each galaxy.

Sacra, Cameron (Sophomore, Studio Arts, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

UARIZONA ASCEND: HIGH-ALTITUDE DATA COLLECTION WITH A CUSTOM CUBESAT PAYLOAD

CubeSats have been a rapidly growing technology over the last decade due to their diminutive total mass to orbit while maintaining spacecraft performance. However, due to their small form factor, CubeSats are extremely limited in the amount of electronics and power storage that they can carry. Within the bounds of a standard 1U CubeSat, the UArizona ASCEND payload houses an atmospheric profiling system to collect data up to 100,000 feet. The project incorporates low power considerations, volume optimization, and high durability 3D printing to improve on the University's previous ASCEND launches. The CubeSat uses durable PETG thermoplastic polyester to ensure the safety of the housing. In addition, two traditional small form factor cameras collect unique views of Earth's atmosphere throughout the ascent and descent of the payload.

Sample, Matthew (Sophomore, Electrical Engineering, Glendale Community College). Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College. [ASCEND-8]

GCC ASCEND PROJECT 2: PAYLOAD SENSORS AND LIVE DATA TRANSMISSION

The ASCEND program at Glendale Community College is a two-semester course that takes students through the process of building small payloads to fly on a high-altitude weather balloon for the purpose of gathering data. Students are divided into 2 teams, with each payload required to be under 680g, (1.5-lb). During the fall semester, students etched and drilled a custom circuit board, and an Arduino Pro Microprocessor was then soldered onto it. Both payloads successfully measured the internal and external temperatures, acceleration, pressure, and battery voltage, while recording video throughout the flight. For the spring semester, our team's payload was designed to also include a Geiger counter, a GPS module, an external microphone, a satellite modem to send live data in five-minute intervals, and a piezo-electric buzzer programmed to sound once payload landed. This application of theoretical knowledge to a real-world engineering project has helped prepare students for future STEM careers.

Sanchez, Rafael (Sophomore, Mechanical Engineering, Phoenix College). Mentor: Eddie Ong, Physical Sciences, Phoenix College. [ASCEND-10]

ENHANCING LAUNCH DYNAMICS: INTEGRATING SENSORS AND STABILIZATION FOR ADVANCED ATMOSPHERIC ANALYSIS

The Phoenix College NASA ASCEND team has maintained a longstanding engagement in launch activities. Our focus revolves around enhancing fabrication techniques and standardization protocols for components within our carbon fiber reinforced vehicle. Integration of sensors for light experiments is underway to facilitate altitude-dependent measurements and to capture behavioral data of the vehicle during launch sequences. Notably, for the Spring 2024 launch, our endeavors extend to deploying two Geiger counters: one for beta and gamma radiation assessment across altitudinal gradients, with the other aimed at neutron detection at varying elevations to ascertain the Pfotzer–Regener maximum. Concurrently, efforts are directed towards refining stabilization of captured videos, with the incorporation of an upward-looking camera for enhanced observation. Additionally, a pre-launch cooling mechanism has been devised and implemented to optimize vehicle performance.

Sandoval, April (Sophomore, Computer Science, Glendale Community College). Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College. [ASCEND-8]

GCC ASCEND PROJECT 2: PAYLOAD SENSORS AND LIVE DATA TRANSMISSION

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Santos, Christopher (Sophomore, Civil Engineering, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CAC BETA X

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO_2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Saville, Embrey (Junior, Chemistry, Northern Arizona University). Mentor: Anita Antoninka, School of Forestry, Northern Arizona University. [B-1]

THE RELATIONSHIP BETWEEN BIOLOGICAL SOIL CRUST, EXTRACELLULAR POLYMERIC SUBSTANCES, AND SOIL EROSION ON VARYING SUBSTRATES TO INVESTIGATE BIOSIGNATURES ON MARS

Biological soil crusts (biocrusts), composed of moss, lichen, cyanobacteria, and associated microorganisms are crucial in reducing erosion of Earth's drylands. Much of this erosion reduction is from extracellular polymeric substances (EPS)–a sticky protective biopolymer excreted by biocrust that adheres to iron oxides and clays, making it significant as a biosignature on Mars. This study investigates biocrust and EPS development on mixtures of various substrates including Mars regolith. The biocrusts were inoculated in a greenhouse and monitored with weekly point-intercept framing and biweekly EPS sampling along with chemical extraction through phenol sulfuric assay using a fluorescence microplate reader. Results indicate an overall increase in biocrust cover and a decline in the primary colonizer, light cyanobacteria. Sand-dominated substrates outperformed clay-dominated substrates and Mars regolith simulant cultivation caused an unknown chemical precipitate absorbed by biocrust, affecting growth. This study promotes further research on possible Martian biosignatures and biocrust-mediated erosion resistance on Earth.

Schluterman, Kya (Junior, Space Physics, Embry-Riddle Aeronautical University). Mentor: Michele Zanolin, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-4]

DISTRIBUTIONAL METHODS FOR DETECTING SUPERNOVA GRAVITATIONAL WAVES

The goal of the project is to investigate the potential of different distributional methods in the detection of Core-Collapse supernova (SN) gravitational waves for quiet signals that would have been previously missed. To date, no supernova GW detections have been made; coherent WaveBurst (cWB) looks at the loudest 'event' in a span of time data and forms its metrics for that event. Our process looks at larger distributions of candidates. This statistical approach allows us to look for GWs at the strongest events as well as those at lower signal-to-noise ratios (SNR). Our method could extend the reach of the LIGO interferometers and with this increased range, the volume of SN we consider as candidates goes at a cubic rate. This method would be able to assist with new SN Candidates and all candidates in the past LIGO observation runs.

Schmidt, Ryan (Junior, Engineering, Phoenix College). Mentor: Eddie Ong, Physical Sciences, Phoenix College. [ASCEND-10]

ENHANCING LAUNCH DYNAMICS: INTEGRATING SENSORS AND STABILIZATION FOR ADVANCED ATMOSPHERIC ANALYSIS

The Phoenix College NASA ASCEND team has maintained a longstanding engagement in launch activities. Our focus revolves around enhancing fabrication techniques and standardization protocols for components within our carbon fiber reinforced vehicle. Integration of sensors for light experiments is underway to facilitate altitude-dependent measurements and to capture behavioral data of the vehicle during launch sequences. Notably, for the Spring 2024 launch, our endeavors extend to deploying two Geiger counters: one for beta and gamma radiation assessment across altitudinal gradients, with the other aimed at neutron detection at varying elevations to ascertain the Pfotzer–Regener maximum. Concurrently, efforts are directed towards refining stabilization of captured videos, with the incorporation of an upward-looking camera for enhanced observation. Additionally, a pre-launch cooling mechanism has been devised and implemented to optimize vehicle performance.

Shanbhag, Saket (Junior, Electrical Engineering, Arizona State University). Mentor: Tracee Jamison-Hooks, School of Earth and Space Exploration, Arizona State University. [E-13]

FPGA-BASED RADAR SIGNAL PROCESSING

Millimeter wave RADAR can measure the 3D mass distribution of volcanic ash inside eruption plumes and their nearby drifting ash clouds. Millimeter wavelengths are better matched to typical ash particle sizes offering better sensitivity than longer wavelengths in conventional RADAR measurements, as well as the unique ability to directly measure ash particle size. Here we present the RADAR portion of the Water and Ash Millimeter Spectrometer instrument using the Xilinx RFSoC Field Programmable Gate Array (FPGA) Evaluation board for command and digital signal processing. Using this FPGA is beneficial due to its massively parallel structure allowing for increased efficiency as well as the numerous on-board ADC's (Analog-to-Digital converters) and DAC's (Digital-to-Analog converters) that would be used heavily in this application.

Shepard, Els (First-Year, Aerospace Engineering, Astronautics, Arizona State University). Mentor: Tom Sharp, School of Earth and Space Exploration, Arizona State University. [ASCEND-4]

ANALYSIS OF EXTRATERRESTRIAL RADIATION'S IMPACT ON OZONE AND ITS IMPLICATIONS FOR CLIMATE AND HEALTH ON A HIGH-ALTITUDE BALLOONING PAYLOAD

In Fall 2023, the purpose of the ASCEND flight was to complete a Meteorology science mission. The meteorological mission used pressure, internal and external temperature, GPS, and accelerometer to monitor barometric pressure in relation to the storm system passing through Arizona during that launch. In Spring 2024, ASCEND used a UV sensor and Geiger-Müller tube to explore the link between solar wind radiation, UVB radiation, and ozone layer dynamics. Post-flight, correlations between radiation levels and ozone layer effects were analyzed in order to determine extraterrestrial radiation's impact on ozone and its implications for climate and health. Overall, ASCEND created a reusable design for the printed circuit board (PCB) and designed an advanced payload capable of withstanding a flight in the atmosphere and impact landing, while keeping its contacts intact.

Shields, Tristen (Sophomore, Physics, Astronomy, University of Arizona). Mentor: Eduardo Rozo, Physics, University of Arizona. [A-13]

FITTING DENSITY PROFILES OF DYNAMICAL DARK MATTER HALOS

Dark matter halos provide the gravitational scaffolding necessary for galaxy formation. Traditionally, halos are defined by drawing a sphere around its center that encloses a specific density. However, recent work has suggested halos can be better defined through their individual particles. Dynamical halos are defined as the collection of particles that are orbiting the halo’s center. Using a fitting function for the density profiles of dynamical halos, we demonstrate that the function provides accurate fits to data of halo densities from a cosmological simulation. While this model has two free parameters, we find they are tightly correlated. Thus, the distribution of density profiles of dynamical halos can be characterized in terms of a single structural parameter, which we call the halo radius.

Shughart, Mackenzie (Senior, Mechanical Engineering (Propulsion), Embry-Riddle Aeronautical University). Mentors: Kathryn Wesson, Applied Aviation Sciences, and Yabin Liao, Aerospace Engineering, Embry-Riddle Aeronautical University. [NEBP-3]

ECLIPSE BALLOON PROJECT

The Nationwide Eclipse Ballooning Project (NEBP) is a scientific research initiative focused on studying the impact of eclipses on the atmosphere. Through advanced sensors, cameras, and modern equipment, the project aims to collect data both during the eclipse event and remotely, to better understand atmospheric patterns and the space environment. The project's payload includes four cameras (IR, Visible, and Wide Angle) and a group of sensors that will capture the atmospheric profile during the balloon flight mission. The SysML Model is used to capture project data, which is a leading standard. This model captures the payload design, requirements, test plans, and measures using Catia Magic. The data collected during this project can be used to improve weather forecasting, climatological research, and environmental effects on spacecraft. The project's main goal is to provide knowledge about eclipses and their effect on the atmosphere.

Sink, Joshua (Sophomore, Aerospace Engineering, Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [ASCEND-4]

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Soto-Lopez, Alexandra (Sophomore, Electrical Engineering, Arizona Western College). Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma. [ASCEND-9]

EXPLORING ATMOSPHERIC DYNAMICS: A COLLABORATIVE ENDEAVOR IN AIR QUALITY RESEARCH

This project is a collaboration between Arizona Western College, University of Arizona-Yuma, and Arizona State University Online on a first payload from the Western Engineering Science and Technology (WEST) Club. Students decided to investigate air quality as a function of altitude. For this first iteration, students determined that it would be practical to concentrate on retrieving data from one sensor and the payload's structure. With the data collected on temperature, pressure, and altitude, we can discern the correlation between temperature and pressure with varying altitudes. The team split into two groups: hardware/software and structural. The hardware/software team used Arduino hardware and coding alongside a microSD card. Meanwhile, the structural team used a junction box and Styrofoam, among other materials, to create the payload. This experience helped students learn how their courses are applied to real-world engineering projects while conducting research that could benefit humanity.

Stanfield Brown, Davy (Senior, Aerospace Engineering, Embry-Riddle Aeronautical University). Mentor: Lance Traub, Aerospace Engineering, Embry-Riddle Aeronautical University. [C-2]

CHARACTERIZATION OF THE EFFECTS OF SWEEP AT LOW REYNOLDS NUMBER

The project is an investigation of wing sweep at low Reynolds numbers. Sweep is the offset of the wing from the direction of flow. The research idea is founded on the growing popularity of small-scale drones. Unmanned aerial vehicles (UAVs) and micro air vehicles (MAVs) have seen an increase in use. Efficient design of UAVs and MAVs requires a better understanding of their associated aerodynamics. This need has contributed to an increase in research regarding various wing designs. For the project, the effects of wing sweep were examined. The wings, comprised of two airfoil profiles, were manufactured with leading edge angles from 0 to 45 degrees. Testing encompassed experimental load measurement at Reynolds number ranging from 40,000 - 80,000. The trends found were consistent for both airfoils. Sweep was observed to increase wing efficiency and performance as reflected in the maximum lift to drag ratio and maximum lift coefficient achieved.

Summers, Jake (Junior, Astrophysics, Physics, Mathematics, Arizona State University). Mentor: Rogier Windhorst, School of Earth and Space Exploration, Arizona State University. [A-22]

SEARCHING FOR RED RINGS FROM WEAK AGN WITH JWST NIRCAM

We use the James Webb Space Telescope (JWST) Near Infrared Camera (NIRCam) data from the Prime Extragalactic Areas for Reionization and Lensing Science (PEARLS) program to search for red dust rings around mid-redshift galaxies which could be produced by dust outflows from weak Active Galactic Nuclei. We first identify galaxies by-eye in color images, which exhibit apparent ring-like structure. We fit galactic spectra to promising galaxy candidates to obtain preliminary information about their redshift. We then fit galactic templates to search for a residual ring structure, and we use this to deduce information about each galaxy's radial profile. If a significant number of such galaxies are found, they could provide evidence of biconical galactic dust outflows in the circumgalactic medium.

Thurman, Tyler (Senior, Computer Engineering, Embry-Riddle Aeronautical University). Mentor: Ahmed Sulyman, Computer, Software, and Electrical Engineering Department, Embry-Riddle Aeronautical University. [G-5]

EMBEDDED SOFTWARE DEVELOPMENT FOR THE EAGLESAT 2 MEMORY DEGRADATION EXPERIMENT

The Memory Degradation Experiment (MDE) is the scientific payload of the EagleSat 2 project, a CubeSat. It will investigate the effects of high-energy cosmic rays on various types of computer memory. MDE is an embedded system, or a computer dedicated to a specific purpose within a larger device. For EagleSat 2, MDE handles data collection from the various types of memory being evaluated. Writing the software on this embedded system has presented some unique development and testing challenges. Factors such as limited visibility into program internals and bugs related to hardware interactions demanded uncommon solutions. These solutions included, among other methods, a user menu to view program internals and signal analysis to characterize hardware traits. After addressing these challenges, a minimum viable program for MDE has been achieved, and an optimized version is mostly complete and undergoing testing.

Tober, Lindsey (Junior, Technological Leadership, Arizona State University). Mentor: Eric Stribling, Interplanetary Initiative, Arizona State University. [F-5]

SPACE FOR HUMANS

Space technical designs have unintended consequences for different societal stakeholders, yet also have wide benefits to society that are often invisible. Based on research conducted by ASU's Space Exploration and Sustainable Development project, the team discusses the importance of space technologies in daily life and issues central to ethical and inclusive space design. The team launched a YouTube channel on March 1 in collaboration with EdPlus. The author has contributed research, scriptwriting, video hosting, editing, assistant producing, and advertising for this new educational YouTube Channel. The project team has interviewed an astronaut, a space mission lead, and been featured on both NPR and the Desert Botanical Gardens. It has involved fifteen students and eight faculty members. The channel has grown at two times the average channel growth rate. The project goal is to create public awareness around space sustainability and ethical space design to a wider audience.

Todd, Mitchell (Sophomore, Mechanical Engineering (Computational Mechanics), Arizona State University). Mentor: Anoop Grewal, Engineering Academic and Student Affairs, Arizona State University. [E-5]

OPTIMIZATION OF INVERSE KINEMATICS WITH DEEP LEARNING

Inverse kinematics, which determines the necessary joint configuration of a robotic manipulator given a desired end effector position, is a crucial process in robotics. Inverse kinematics stems from forward kinematics, which determines a desired end effector position given known joint configurations. While forward kinematics problems can usually be solved with simple trigonometric functions, inverse kinematics demands complex computations. This study proposes avoiding these computations by utilizing deep neural networks to map all the possible end effector positions of a robotic manipulator to their respective joint configurations. Utilizing MATLAB's Deep Learning Toolbox, the accuracy of various neural network architectures are evaluated. The proposed implementation of deep neural networks into inverse kinematics is significant for its ability to reduce computation times, which can be especially demanding as the degrees of freedom of a robotic manipulator increases. This ultimately increases the viability of solving inverse kinematics in real-time scenarios.

Topiwala, Muhammed Hunaid (Sophomore, Computer Science (Software Engineering), Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [NEBP-5]

ATMOSPHERIC PHENOMENA ANALYSIS DURING SOLAR ECLIPSES BY THE ARIZONA SOUTH TEAM: A STUDY OF ENVIRONMENTAL CHANGES AND VIDEO RECORDING AT HIGH ALTITUDES

The AZ South team comprises ASU, UA, GCC, and CGUHS. Our main goal is to analyze atmospheric data between 70,000 to 85,000 feet during the 10/14/23 Annular Solar Eclipse in Roswell, NM, and the 04/08/24 Total Solar Eclipse in Uvalde, TX. Two types of data are useful to study and understand the phenomena of the moon's shadow passing the Sun: (1) changes in pressure, temperature, density, and wind speed against the altitudes and atmosphere's layers and (2) live video recording of the totality and the Sun's corona. To achieve these feats, we have to (a) determine a suitable weather balloon launch time, launch site, expected altitude during the totality, and landing location, (b) integrate payload housings to ensure the integrity and functionality of all systems, (c) establish ground station communication of the Raspberry Pi video streaming and Ubiquiti's long-range network and (d) control the balloon's vent/cutdown via Iridium satellite.

Topiwala, Muhammed Hunaid (Sophomore, Computer Science (Software Engineering), Arizona State University). Mentor: Thomas Sharp, School of Earth and Space Exploration, Arizona State University. [ASCEND-4]

ANALYSIS OF EXTRATERRESTRIAL RADIATION'S IMPACT ON OZONE AND ITS IMPLICATIONS FOR CLIMATE AND HEALTH ON A HIGH-ALTITUDE BALLOONING PAYLOAD

The purpose of the ASCEND flights are to complete various Meteorology science missions. In Fall 2023, the meteorological mission used pressure, internal and external temperature, GPS, and accelerometer to monitor barometric pressure in relation to the storm system passing through Arizona during that launch. In Spring 2024, ASCEND used a UV sensor and Geiger-Müller tube to explore the link between solar wind radiation, UVB radiation, and ozone layer dynamics. Post-flight, correlations between radiation levels and ozone layer effects were analyzed in order to determine extraterrestrial radiation's impact on ozone and its implications for climate and health. Concurrently, the mission's flight software underwent a redesign, adopting an object-oriented paradigm (OOP) to enhance scalability and risk mitigation while a reusable design for the printed circuit board (PCB) was implemented. Overall, ASCEND created an advanced payload capable of withstanding a flight in the atmosphere and impact landing, while keeping its contacts intact.

Torres, Noah (Junior, Welding, Arizona Western College). Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma. [ASCEND-9]

EXPLORING ATMOSPHERIC DYNAMICS: A COLLABORATIVE ENDEAVOR IN AIR QUALITY RESEARCH

This project is a collaboration between Arizona Western College, University of Arizona-Yuma, and Arizona State University Online on a first payload from the Western Engineering Science and Technology (WEST) Club. Students decided to investigate air quality as a function of altitude. For this first iteration, students determined that it would be practical to concentrate on retrieving data from one sensor and the payload's structure. With the data collected on temperature, pressure, and altitude, we can discern the correlation between temperature and pressure with varying altitudes. The team split into two groups: hardware/software and structural. The hardware/software team used Arduino hardware and coding alongside a microSD card. Meanwhile, the structural team used a junction box and Styrofoam, among other materials, to create the payload. This experience helped students learn how their courses are applied to real-world engineering projects while conducting research that could benefit humanity.

Traynor, Zachary (Senior, Electrical Engineering, Embry-Riddle Aeronautical University). Mentor: John Pavlina, Electrical, Computer, & Software Engineering Department, Embry-Riddle Aeronautical University. [E-10]

BATHYMETRIC LIDAR: INVESTIGATION OF OPTIMAL VISIBLE LIGHT FOR NON-IDEAL AQUATIC ENVIRONMENTS

The purity of water is a critical factor in various industrial applications, including Bathymetric LiDAR, which relies on the transmission and reception of laser beams through water to capture underwater topography. Water quality can affect the performance of LiDAR systems, as impurities and suspended particles lead to light attenuation, impacting the accuracy and detail of the data. The project's objective is to investigate the relationship between water purity and its effects on visible light spectrum lasers, focusing on light attenuation methods and quantitatively identifying the optimal visible light laser for Bathymetric LiDAR. Accurate and detailed underwater mapping relates to fields in defense, security, and space exploration, which includes: submarine navigation, harbor security, and potentially moon subsurface water exploration and mapping. By analyzing impure water on laser performance, we enhance the accuracy and reliability of LiDAR systems in complex settings and contribute to stronger security and new pathways of space exploration.

Tunstall, Hannah (Sophomore, Computer Engineering, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CAC BETA X

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

Vanica, Edward (Junior, Aerospace Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

UARIZONA ASCEND: HIGH-ALTITUDE DATA COLLECTION WITH A CUSTOM CUBESAT PAYLOAD

CubeSats have been a rapidly growing technology over the last decade due to their diminutive total mass to orbit while maintaining spacecraft performance. However, due to their small form factor, CubeSats are extremely limited in the amount of electronics and power storage that they can carry. Within the bounds of a standard 1U CubeSat, the UArizona ASCEND payload houses an atmospheric profiling system to collect data up to 100,000 feet. The project incorporates low power considerations, volume optimization, and high durability 3D printing to improve on the University's previous ASCEND launches. The CubeSat uses durable PETG thermoplastic polyester to ensure the safety of the housing. In addition, two traditional small form factor cameras collect unique views of Earth's atmosphere throughout the ascent and descent of the payload.

Venkadesh, Divya (Senior, Aerospace Engineering, University of Arizona). Mentor: Michelle Coe, Lunar and Planetary Laboratory, University of Arizona. [ASCEND-1]

UARIZONA ASCEND: HIGH-ALTITUDE DATA COLLECTION WITH A CUSTOM CUBESAT PAYLOAD

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Vester, Olivia (Junior, Computer Science, Northern Arizona University). Mentor: Kayode Oshinubi, School of Informatics, Computing, and Cyber Systems, Northern Arizona University. [D-8]

BUILDING COMPUTATIONAL MODELS TO UNDERSTAND THE INTERPLAY BETWEEN CLIMATIC FACTORS, AIR, TRANSPORTATION, AND INFECTIOUS DISEASE DYNAMIC

The purpose of this project was to build math models to predict when and where there will be high risk of West Nile Virus to humans; these models were made in a new software system called epymorph. These risk levels are dependent on bird and mosquito dynamics which are dependent on climate and targeting this risk is significant because the virus can lead to debilitating conditions and even death. This data is being captured because Arizona's Maricopa County is consistently in the top ten counties in the nation for West Nile Virus and neuroinvasive disease; highlighting the risk in this area is essential for predicting overall risk levels for humans. The models reflect predicted data for disease prevalence and species abundance over a 14 year period and can be compared to real data from that time to show accuracy of the predictions.

Villanueva, Aliceanna (First-Year, Engineering, Casa Grande Union High School). Mentor: John Morris, Career and Technical Education, Casa Grande Union High School. [ASCEND-6]

EXPLORING THE MARTIAN AGRICULTURE FRONTIER: ASSESSING TOMATO ADAPTABILITY THROUGH HIGH ALTITUDE EXPERIMENTATION

Our objective is to assess the viability of tomato seeds exposed to Mars-like conditions by sending them into the Earth's stratosphere. Our high-altitude balloon payload exposes commercially bought seeds to extreme temperatures, low pressure, UV, and beta and gamma radiation. We will compare these seeds with a control group kept in our lab. Upon return, both sets will be planted in a controlled hydroponic greenhouse. Subsequent electrophoresis tests will reveal any genetic variations. As a long-term study, we'll harvest seeds from the experimental plants for future flights, aiming to observe cumulative genetic changes over five generations. This research aims to demonstrate potential genetic mutations in tomato seeds under extreme conditions, providing insights into sustainable agriculture for future Mars colonization efforts.

Villasana, Michael (Senior, Electrical and Computer Engineering, University of Arizona). Mentor: Jekan Thanga, Aerospace and Mechanical Engineering, University of Arizona. [E-6]

SMART SANDBAG FOR AUTONOMOUS LUNAR CONSTRUCTION

NASA's Artemis program aims to establish a sustainable human presence on the Moon, vital for future missions to Mars. Overcoming lunar construction challenges, particularly in the harsh environment, requires innovative solutions. Smart sandbags, equipped with multifunctional sensors, play a crucial role in solving these lunar challenges. These sandbags assist in location estimation, orientation and positioning for robots during assembly, leveraging interplanetary CubeSat-class microprocessors that can also be used for a distributed network. By integrating smart sandbags into a prototype sensor network alongside autonomous robots, a promising solution emerges. Currently, multiple prototypes are being tested to see the effectiveness of these sensor networks deployed in smaller sandbags. Future iterations will focus on refining these sandbags for real-world adaptability, offering a significant advancement in lunar infrastructure. This innovative approach not only facilitates lunar construction but also paves the way for human exploration beyond Earth's orbit.

Weissbluth, Eyan (Sophomore, Astrophysics, Arizona State University). Mentor: Sanchayeeta Borthakur, School of Earth and Space Exploration, Arizona State University. [A-6]

EXAMINING THE STELLAR POPULATION OF NGC 3344

Extended Ultraviolet (XUV) disk galaxies are galaxies that exhibit star formation beyond their optical disk. Traditionally, star formation would not be expected in these regions. Recent studies, however, suggest that they are experiencing inside-out disk formation. Through observing XUV galaxies such as NGC 3344, a barred spiral galaxy, new insights into the history of stellar evolution can be understood. After extracting stellar associations in NGC 3344 aperture photometry, which is a technique used in astronomy to measure the intensity of light radiated by objects, is used to generate the colors of each population of stars. Using this data with stellar evolutionary models, in order to accurately compare this data to other known phenomena, new understandings of the processes of star formation are found.

Wilde, Aurora (Sophomore, Physics, Astronomy, University of Arizona). Mentor: Yancy Shirley, Astronomy and Steward Observatory, University of Arizona. [A-23]

A SURVEY OF SINGLY-DEUTERATED AMMONIA IN PRESTELLAR CORES IN THE TAURUS MOLECULAR CLOUD

The first observable phase of star formation is the prestellar core. Because the cores are so cold and dense, most molecules are frozen out onto dust grains. Singly deuterated ammonia (NH2D) is ammonia with one deuterium (a heavier isotope of hydrogen) in place of one of the hydrogen atoms. It is in the gas phase in these conditions, making it a good probe of these cores. This molecule has two symmetry states, ortho and para. This survey is particularly interested in determining the ortho to para ratio, which will help constrain the chemical evolution of the core. To do this, the Arizona Radio Observatory’s Submillimeter Telescope atop Mt. Graham was used to observe NH2D in several prestellar cores in the Taurus Molecular Cloud. The observations were analyzed to characterize statistical and systematic uncertainties in determining the ortho to para ratio.

Wilson, Garret (Senior, Molecular and Cellular Biology, Computer Science, University of Arizona). Mentor: Sawsan Wehbi, Ecology and Evolutionary Biology, University of Arizona. [B-13]

PROTEIN DOMAINS WITH UNBALANCED AMINO ACID USAGE ARE DIFFERENTIALLY LOST

Proteins, like most species, can go extinct. The differential retention mechanism of protein evolution postulates that different properties of protein sequences affect the likelihood of losing a sequence in a population. The differential retention (loss) rate was previously calculated for 6700 protein domain sequences, by identifying instances where a sequence was lost along the branches of a species tree. We hypothesize that loss rates are affected by amino acid frequencies and intrinsic structural disorder (i.e., unfolded peptide regions). Empirical investigation of these properties reveals that the amino acid frequencies corresponding to minimum loss strongly explain the average amino acid frequencies. Moreover, a protein domain that greatly deviates from the average amino acid frequencies has a loss rate 29x greater than a domain that only slightly deviates. Finally, improved disorder estimates showed that retention is predicted by low ISD rather than by intermediate ISD.

Wszalek, Charles (Junior, Space Physics, Embry-Riddle Aeronautical University). Mentor: Michele Zanolin, Physics and Astronomy, Embry-Riddle Aeronautical University. [A-1]

NOISE REDUCTION IN LOW FREQUENCY LIGO DETECTORS

The objective is looking into how to improve the detection capabilities of low-frequency gravitational waves. The current generation of gravitational wave detectors is not focused on the low-frequency end of the spectrum, and this project aims to study the low frequency noise so that a detector can be made more effective. Another aspect of this project will be to build a functional representation of the LIGO mirrors to learn about their natural frequencies and how to mitigate the low frequency noise due to these natural frequencies. Since the noise most common in the LIGO interferometer is in the low-frequency range, the same range as low-frequency gravitational waves, reducing the noise will allow LIGO to detect these gravitational waves.

Yamaner, Anil (Junior, Industrial Engineering, University of Arizona). Mentor: Samuel Peffers, Systems and Industrial Engineering, University of Arizona, Yuma. [ASCEND-9]

EXPLORING ATMOSPHERIC DYNAMICS: A COLLABORATIVE ENDEAVOR IN AIR QUALITY RESEARCH

This project is a collaboration between Arizona Western College, University of Arizona-Yuma, and Arizona State University Online on a first payload from the Western Engineering Science and Technology (WEST) Club. Students decided to investigate air quality as a function of altitude. For this first iteration, students determined that it would be practical to concentrate on retrieving data from one sensor and the payload's structure. With the data collected on temperature, pressure, and altitude, we can discern the correlation between temperature and pressure with varying altitudes. The team split into two groups: hardware/software and structural. The hardware/software team used Arduino hardware and coding alongside a microSD card. Meanwhile, the structural team used a junction box and Styrofoam, among other materials, to create the payload. This experience helped students learn how their courses are applied to real-world engineering projects while conducting research that could benefit humanity.

Yoder, Adrian (Sophomore, Computer Science, Glendale Community College). Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College. [ASCEND-8]

GCC ASCEND PROJECT 2: PAYLOAD SENSORS AND LIVE DATA TRANSMISSION

The ASCEND program at Glendale Community College is a two-semester course that takes students through the process of building small payloads to fly on a high-altitude weather balloon for the purpose of gathering data. Students are divided into 2 teams, with each payload required to be under 680g, (1.5-lb). During the fall semester, students etched and drilled a custom circuit board, and an Arduino Pro Microprocessor was then soldered onto it. Both payloads successfully measured the internal and external temperatures, acceleration, pressure, and battery voltage, while recording video throughout the flight. For the spring semester, our team's payload was designed to also include a Geiger counter, a GPS module, an external microphone, a satellite modem to send live data in five-minute intervals, and a piezo-electric buzzer programmed to sound once payload landed. This application of theoretical knowledge to a real-world engineering project has helped prepare students for future STEM careers.

Yonan, Kevin (Junior, Computer Systems Engineering, Glendale Community College). Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College. [ASCEND-7]

GCC ASCEND, TEAM ICARUS: TESTING NEW DIGITAL SENSORS AND DETECTING UV LIGHT

During the fall semester, the ASCEND teams at GCC designed and built payloads that were attached to a high-altitude weather balloon, which rose to over 100,000ft. These payloads successfully measured temperature, pressure, and acceleration with analog sensors, while also recording video throughout the flight. Starting with this basic design, during the spring semester our team also measured ultraviolet light and used two new I 2 C digital sensors; one was a three-axis accelerometer and gyroscope, while the other measured temperature and pressure. Including these new digital sensors allowed for a direct comparison between the data collected with analog and digital sensors. The payload also included a GPS sensor and an Iridium modem to transmit data via satellites every 5 minutes. This allowed our team to track the payload's path during its flight independent of the GPS information provided by ANSR, while also correlating the data collected with the payload's altitude.

Youssfi, Lina (Sophomore, Aerospace Engineering, Arizona State University). Mentor: Timothy Takahashi, School of Engineering, Matter, Transport and Energy, Arizona State University. [C-4]

AEROSPACE ALLOY ADVANCEMENTS

In the world of aerospace engineering, material advancements play a pivotal role in shaping the future of flight. Among the several materials prevalent in the aerospace industry, alloys stand out as they provide the resilience, strength, durability and versatility demanded by the conditions these aircrafts are subjected to. From the pioneering days of space flight to the present day cutting-edge technologies, alloys have been supplying the industry's constant demand for safety, efficiency, fuel economy and sustainability. In order to be able to understand the need for these constant developments, one needs to grasp the characteristics of these alloys to discern why particular types are in demand for different applications. This research navigates through the pivotal milestones in alloy developments, spotlighting the breakthroughs that propel the aerospace sector.

Zapata, Mac (Sophomore, Science, Glendale Community College). Mentors: Tim Frank, Engineering, and Rick Sparber, Technology and Consumer Sciences, Glendale Community College. [ASCEND-7]

GCC ASCEND, TEAM ICARUS: TESTING NEW DIGITAL SENSORS AND DETECTING UV LIGHT

During the fall semester, the ASCEND teams at GCC designed and built payloads that were attached to a high-altitude weather balloon, which rose to over 100,000ft. These payloads successfully measured temperature, pressure, and acceleration with analog sensors, while also recording video throughout the flight. Starting with this basic design, during the spring semester our team also measured ultraviolet light and used two new I 2 C digital sensors; one was a three-axis accelerometer and gyroscope, while the other measured temperature and pressure. Including these new digital sensors allowed for a direct comparison between the data collected with analog and digital sensors. The payload also included a GPS sensor and an Iridium modem to transmit data via satellites every 5 minutes. This allowed our team to track the payload's path during its flight independent of the GPS information provided by ANSR, while also correlating the data collected with the payload's altitude.

Zhu, Zhilong (Sophomore, Electrical Engineering, Central Arizona College). Mentors: Kimberly Baldwin and Armineh Noravian, Science and Engineering, Central Arizona College. [ASCEND-12]

CENTRAL ARIZONA COLLEGE – NASA ASCEND

Two payloads were constructed at Central Arizona College to explore two research areas. Payload one, our control payload, collects temperature, altitude, humidity, and pressure. The goal of this payload is to establish a five-year-long database to have local data to draw from. The goal of the second payload named "Cuisine" is going to contain the sensor from payload one to have backup data for the payload as well as have a G-force sensor. Additionally, there are going to be two different biological experiments. The first experiment is going to have coffee beans and we are going to compare caffeine content after the launch. The second component of the biological experiment is the inclusion of pizza dough. The second payload is going to read how much CO2 the dough is exposed to before baking. The point of this payload is to see if common food items are sustainable in space travel.

2023-2024 Arizona NASA Space Grant Program Mentors

Organized by mentor's last name.

Adams, Johnathan (Humanities and Communications, Embry-Riddle Aeronautical University) See: Robertson, Katrina [F-6].

Andino, Jean (School for Engineering of Matter, Transport and Energy, Arizona State University) See: Negrao, Gabriel [G-7].

Antoninka, Anita (School of Forestry, Northern Arizona University) See: Saville, Embrey [B-1].

Baldwin, Kimberly (Science and Engineering, Central Arizona College)
See: Banda, Karen [ASCEND-12]
Elstad, Sonja [ASCEND-12]
Fisher, Cortney [ASCEND-12]
La Faut, James [ASCEND-12]
Maziarka, Elizabeth [ASCEND-12]
Mendoza, Jose [ASCEND-12]
Mountz, Elijah [ASCEND-12]
Owens, Norma [ASCEND-12]
Rodriguez, Jose [ASCEND-12]
Santos, Christopher [ASCEND-12]
Tunstall, Hannah [ASCEND-12]
Zhu, Zhilong [ASCEND-12].

Borthakur, Sanchayeeta (School of Earth and Space Exploration, Arizona State University)
See: Carl, Naomi [A-2]
Weissbluth, Eyan [A-6].

Bowman, Cassie (School of Earth and Space Exploration, Arizona State University) See: Beauchaine, Samantha [E-7].

Budinoff, Hannah (Systems and Industrial Engineering, University of Arizona) See: Machado Jr., Juan [E-4].

Burr, Devon (Astronomy and Planetary Science, Northern Arizona University) See: Fry, Rachel [D-4].

Butler, Nathaniel (School of Earth and Space Exploration, Arizona State University) See: Earley, Conor [D-5].

Byrne, Shane (Lunar and Planetary Laboratory, University of Arizona) See: Cantin, Chad [E-2].

Carleton, Timothy (School of Earth and Space Exploration, Arizona State University) See: McLeod, Noah [A-8].

Chernoff, William (Sociology and Criminal Justice, Southeastern Louisiana University) See: Felder, James [G-6].

Chien, Lisa (Astronomy and Planetary Sciences, Northern Arizona University)
See: Blair, Kayla [F-10]
Kohm, Jack [A-3].

Chung, Haeun (Astronomy and Steward Observatory, University of Arizona) See: Quirk, Colton [A-18].

Coe, Michelle (Lunar and Planetary Laboratory, University of Arizona)
See: Adamu, Razak [NEBP-5]
Blanchard, Sarina [NEBP-5]
Blanchard, Sarina [ASCEND-1]
Blanchard, Nicolas [ASCEND-1]
Brown, Colin [NEBP-5]
Brown, Colin [ASCEND-1]
Chumley, Ethan [ASCEND-1]
Kwolek, Andrew [NEBP-3]
Lopez Jr., Arturo [ASCEND-1]
Mattison, Kane [ASCEND-1]
Pujary, Vaidehi [NEBP-5]
Sacra, Cameron [ASCEND-1]
Vanica, Edward [ASCEND-1]
Venkadesh, Divya [ASCEND-1].

Condes, AnnMarie (Science and Engineering, Pima Community College)
See: Arcarese, Matthew [ASCEND-11]
Akert, Timothy [ASCEND-11]
Boe, Jordan [ASCEND-11]
Carter, Beau [ASCEND-11]
Navarro, Roberto [ASCEND-11].

Conte, Davide (Aerospace Engineering, Embry-Riddle Aeronautical University) See: Newlin, Kyle [G-9].

Craig, Alex (Aerospace and Mechanical Engineering, University of Arizona) See: Nayyar, Veer [C-3].

Das, Jnaneshwar (School of Earth and Space Exploration, Arizona State University) See: Mata, Anyell [C-5].

De, Subhayan (Mechanical Engineering, Northern Arizona University) See: Morris, Grace [E-12].

Denny, Angelita (Department of Energy, Office of Legacy Management) See: Baker, Elyssa [B-3].

Doughty, Christopher (School of Informatics, Computing, and Cyber Systems, Northern Arizona University) See: Hrabak, Cameron [D-9].

Etling, Chris (Arizona Daily Sun) See: Easton, Madison Marie [F-3].

Frank, Tim (Engineering, Glendale Community College)
See: Englund, Octavian [ASCEND-7]
Islambekov, Samirbek [ASCEND-8]
Reyes Villa, Alejandro [ASCEND-7]
Sample, Matthew [ASCEND-8]
Sandoval, April [ASCEND-8]
Yoder, Adrian [ASCEND-8]
Yonan, Kevin [ASCEND-7]
Zapata, Mac [ASCEND-7].

Garani, Jasmine (Astronomy and Planetary Science, Northern Arizona University) See: Brooks, Hunter [A-25].

Gehring, Catherine (Center of Adaptable Western Landscapes, Northern Arizona University) See: Garza, Gabriella [B-7].

Ghavari, Lance (Herberger Institute For Design and the Arts, Arizona State University) See: Marquez, Matthew [F-2].

Gowanback, Michael (School of Informatics, Computing, and Cyber Systems, Northern Arizona University) See: Hrabak, Cameron [D-9].

Grewal, Anoop (Engineering Academic and Student Affairs, Arizona State University) See: Todd, Mitchell [E-5].

Hartnett, Hilairy (School of Earth and Space Exploration, Arizona State University) See: Johnson, Ethan [B-17].

Holbrook, David (Department of Energy, Office of Legacy Management) See: Parrish, Alexis-Marie [B-6].

Hood, Lon (Lunar and Planetary Laboratory, University of Arizona) See: Matlock, Travis [D-2].

Hunter, Marc (USGS Astrogeology Science Center, Northern Arizona University) See: Crook, Virginia [F-7].

Hurst, Stephanie (Chemistry and Biochemistry, Northern Arizona University)
See: Garland, Henry [E-3]
Lamborn, Selena [E-9].

Ivanova, Dorothea (Applied Aviation Sciences, Embry-Riddle Aeronautical University) See: Lang, Victoria [B-8].

Jacobs, Danny (Interplanetary Laboratories, Arizona State University) See: Cooper, Genevieve [G-10].

Jamison-Hooks, Tracee (School of Earth and Space Exploration, Arizona State University) See: Shanbhag, Saket [E-13].

Johns, Kenneth (Physics, University of Arizona) See: Polk, David [A-16].

Karanikola, Vasiliki (Environmental Engineering, University of Arizona) See: Haan, Abigail [B-4].

Kaufman, Darrell (School of Earth and Sustainability, Northern Arizona University) See: Hardt, Tatum [B-12].

Kim, J. Serena (Astronomy, University of Arizona) See: Kalish, Taylor [A-10].

Kinsey, Brian (Aerospace and Mechanical Engineering, University of Arizona) See: Nayyar, Veer [C-3].

Kortenkamp, Steve (Lunar and Planetary Laboratory, University of Arizona) See: Kupersmith, Alexandra [F-9].

Lance, Traub (Aerospace Engineering, Embry-Riddle Aeronautical University) See: Bennett, Kylee [C-2].

Lanning, David (Aerospace Engineering, Embry-Riddle Aeronautical University)
See: Bleakley, Nathan [E-1]
Roulston, Winona [E-1].

Li, Mingming (School of Earth and Space Exploration, Arizona State University) See: Das, Ritisha [D-12].

Liao, Yabin (Aerospace Engineering, Embry-Riddle Aeronautical University)
See: Grullon, Somaralyz [ASCEND-2]
Reed, Chloe [ASCEND-2]
Shughart, Mackenzie [NEBP-3].

Loeffler, Mark (Astronomy and Planetary Science, Northern Arizona University) See: Clark, Emily [D-10].

Margolis, David (Orthopedic Surgery, University of Arizona) See: Almanzar, Leonel [E-8].

McClernan, Mark (US Geological Survey) See: Maldonado, Jessica [D-11].

Morris, John (Career and Technical Education, Casa Grande Union High School)
See: CGUHS ASCEND [D-7]
Buchanan, Zacheriah [ASCEND-6]
Geen, Emily [ASCEND-6]
Howard, Landri [ASCEND-6]
Limon, Melody [ASCEND-6]
Morgan, Ethan [ASCEND-6]
Ramirez, Elijah [ASCEND-6]
Villanueva, Aliceanna [ASCEND-6].

Nichols, Mary (USDA-ARS Southwest Watershed Research Center) See: Esparza, John [B-10].

Noble, Allison (School of Earth and Space Exploration, Arizona State University)
See: Montano, Sebastian [A-11]
Saavedra, Sarah [A-14].

Noravian, Armineh (Science and Engineering, Central Arizona College)
See: Banda, Karen [ASCEND-12]
Elstad, Sonja [ASCEND-12]
Fisher, Cortney [ASCEND-12]
La Faut, James [ASCEND-12]
Maziarka, Elizabeth [ASCEND-12]
Mendoza, Jose [ASCEND-12]
Mountz, Elijah [ASCEND-12]
Owens, Norma [ASCEND-12]
Rodriguez, Jose [ASCEND-12]
Santos, Christopher [ASCEND-12]
Tunstall, Hannah [ASCEND-12]
Zhu, Zhilong [ASCEND-12].

Okubo, Chris (USGS Astrogeology Science Center) See: Freeman, Greta [D-1].

Ong, Eddie (Physical Sciences, Phoenix College)
See: Garcia, Lorynn [ASCEND-10]
Nordmeyer, Garret [ASCEND-10]
Okafor, Nathaniel [ASCEND-10]
Sanchez, Rafael [ASCEND-10]
Schmidt, Ryan [ASCEND-10].

Dinh, Quang Huy [ASCEND-4]
Do, Jacqueline [NEBP-5]
Miller, Megan [NEBP-5]
Moore, Everett [NEBP-5]
Nielsen, Tyler [ASCEND-4]
Ontiveros, Ricardo [ASCEND-4]
Sink, Joshua [ASCEND-4]
Topiwala, Muhammed Hunaid [NEBP-5]
Topiwala, Muhammed Hunaid [ASCEND-4]
Shepard, Els [ASCEND-4].

Shirley, Yancy (Astronomy and Steward Observatory, University of Arizona)
See: Andras-Letanovszky, Hanga [A-15]
Gruber, Hannah [A-19]
Wilde, Aurora [A-23].

Shock, Everett (School of Earth and Space Exploration, Arizona State University) See: Fronmueller, Simon [B-18].

Sparber, Rick (Technology and Consumer Sciences, Glendale Community College)
See: Englund, Octavian [ASCEND-7]
Islambekov, Samirbek [ASCEND-8]
Reyes Villa, Alejandro [ASCEND-7]
Sample, Matthew [ASCEND-8]
Sandoval, April [ASCEND-8]
Yoder, Adrian [ASCEND-8]
Yonan, Kevin [ASCEND-7]
Zapata, Mac [ASCEND-7].

Stolte, Daniel (University Communications, University of Arizona) See: Duran, Penny [F-4].

Stribling, Eric (Interplanetary Initiative, Arizona State University)
See: Garayzar, Elizabeth [B-In Title Only]
Tober, Lindsey [F-5].

Stroud, Rhonda (Buseck Center for Meteorite Studies, Arizona State University) See: Campbell, Sam [F-8].

Sulyman, Ahmed (Department of Computer, Electrical, and Software Engineering, Embry-Riddle Aeronautical University)
See: Dave, Nikhil [G-5]
Henggeler, Calvin [F-1]
Ruddick, Logan [F-1]
Thurman, Tyler [G-5].

Sutton, Sarah (Lunar and Planetary Laboratory, University of Arizona) See: Elalaoui-Pinedo, Dora [D-6].

Takahashi, Timothy (School for Engineering of Matter, Transport and Energy, Arizona State University)
See: Guaglardi, Lucas [C-In Title Only]
Oppen, Ryan [C-1]
Youssfi, Lina [C-4].

Thanga, Jekan (Aerospace and Mechanical Engineering, University of Arizona) See: Villasana, Michael [E-6].

Threadgill, James (Aerospace and Mechanical Engineering, University of Arizona)
See: Bevier, Sam [G-4]
Rhomberg, Rachel [G-8].

Titus, Timothy (USGS Astrogeology Science Center, US Geological Survey) See: Morton, Lucienne [D-3].

Traub, Lance (Aerospace Engineering, Embry-Riddle Aeronautical University) See: Stanfield Brown, Davy [C-2].

Trembath-Reichert, Elizabeth (School of Earth and Space Exploration, Arizona State University) See: Ferrell, Hayden [B-9].

Vargas, Carlos (Astronomy and Steward Observatory, University of Arizona) See: Cardona, Alondra [G-11].

Vaughan, Greg (Astrogeology, US Geological Survey) See: Condon, Jessica [B-14].

Waldrip, Ross (Science and Engineering, Pima Community College)
See: Arcarese, Matthew [ASCEND-11]
Akert, Timothy [ASCEND-11]
Boe, Jordan [ASCEND-11]
Carter, Beau [ASCEND-11]
Navarro, Roberto [ASCEND-11].

Walker, Christopher (Astronomy and Steward Observatory, University of Arizona)
See: Li, Sarah [G-2]
Rahmer, Walter [G-3].

Wehbi, Sawsan (Ecology and Evolutionary Biology, University of Arizona) See: Wilson, Garret [B-13].

Weiner Mansfield, Megan (Steward Observatory, University of Arizona) See: Bartelt, Dare [A-20].

Wesson, Kathryn (Applied Aviation Sciences, Embry-Riddle Aeronautical University) See: Shughart, Mackenzie [NEBP-3].

Windhorst, Rogier (School of Earth and Space Exploration, Arizona State University)
See: Ortiz, Rafael [A-21].
Summers, Jake [A-22].

Yescas, Naomi (Lunar and Planetary Laboratory, University of Arizona)
See: Blanchard, Sarina [E-11]
Qureshi, Ahmad [A-17].

Yoon, Jeong-Yeol (Biomedical and Biosystems Engineering, University of Arizona) See: Falk, Liam [B-2].

Zanolin, Michele (Physics and Astronomy, Embry-Riddle Aeronautical University)
See: Biehle, Miriam [A-7]
Pillon, Brandon [A-1]
Schluterman, Kya [A-4]
Wszalek, Charles [A-1].