LaSPACE Fall 2026 Council Meeting Student Poster Abstract Booklet

"Hyperspectral Remote Sensing of Suspended Sediment Composition for Coastal Erosion Monitoring"

Max Newman | Louisiana State University and A&M College (LSU) | GIRAF | Poster # 1
Presenting Team Members: Max Perry Newman, Oceanography & Coastal Science

Coastal erosion is a major environmental concern in southern Louisiana, but monitoring erosion and the efficacy of restoration interventions is challenging and resource intensive. These efforts are further complicated by subaqueous erosion, which degrades marsh platforms without being detectable from the surface. In 2021, the NASA Delta-X campaign successfully used airborne hyperspectral imaging to investigate suspended sediment quantity and composition in two coastal basins. The current study expands on these methods, using satellite-based multispectral and hyperspectral imaging to analyze patterns of erosion in Barataria Basin and their correlations with suspended sediment. Marsh edge position was tracked over 10 years to quantify erosion rates and identify instances of sudden marsh edge collapse that may be related to subaqueous erosion. New and archived hyperspectral imagery was used to classify total suspended sediment and particulate organic matter in surface waters, with a field sampling campaign providing ground truth data. The suspended sediment data were then analyzed with respect to nearby erosional processes. This approach may offer a novel method for assessing coastal erosion at large spatial scales without intensive field sampling.

"Mapping Oyster Reef Structure and Shoreline Change with UAV-Based LiDAR"

Avi Strange | Tulane University (Tulane) | Space Grant - GIRAF | Poster # 2
Presenting Team Members: Co-authors (not students): Seth Blitch; Fiona Lightbody; Thomas M. DeCarlo

Oyster reefs play an important role in protecting Louisiana's coast by providing habitat, supporting fisheries, and reducing shoreline erosion through wave attenuation. However, oyster reefs have declined 50-85% across the Gulf Coast in recent decades, primarily due to dredging and overharvesting. In response, the Coalition to Restore Coastal Louisiana (CRCL) and The Nature Conservancy (TNC) have constructed approximately 20 km of restored reefs in southern Louisiana to promote oyster recruitment and enhance shoreline protection. However, it remains unclear how reef design influences shoreline stabilization and how reef structure changes over time.

This project uses unmanned aerial vehicle (UAV)-based Light Detection and Ranging (LiDAR) to map restored oyster reef morphology and quantify changes in adjacent marsh shorelines. High-resolution point clouds will be used to characterize reef size, shape, and elevation, along with surrounding shoreline elevation. Repeated surveys of restored reefs and nearby unrestored shorelines will enable the creation of digital surface models and elevation-based change detection to map changes in reef structure and shoreline elevation over time. Accurate survey positioning will be established using GNSS post-processed kinematic (PPK) methods, with GNSS real-time kinematic (RTK) checkpoints used to evaluate the vertical and horizontal accuracy of the LiDAR-measured elevations. By combining high-resolution remote sensing with repeat topographic surveys, this study will quantify changes in reef morphology and shoreline elevation over time.

"Upconverted light emission through lanthanide centered coordination complexes"

Seth Doughty | Louisiana Tech University (LaTech) | Space Grant - GSRA | Poster # 3
Presenting Team Members: Seth Doughty - MSNT

Infrared and near infrared photons represent a substantial portion of underutilized light that can be useful in upconverted light emitting molecular systems. Molecular upconversion offers a way to translate multiple low energy photons into higher energy emission for energy conversion, imaging, and sensing. Development of photon upconverting molecules are highly sought after in the medical field, space exploration, and green energy production initiatives. Some specific applications include: deep space laser communications, counting detectors in space telescopes, and increasing efficiency of solar panels. Some lanthanides, including Yb3+ or Er3+, can emit both near IR photons and upconverted visible photons; however, due to Laporte forbidden 4f-4f transition, their low molar absorptivity means that antenna ligands will be required. Common strategies include coordinating these lanthanide ions to highly conjugated ligands such as dipyrromethene dyes. Our strategy will be to synthesize highly conjugated, extended terpyridine ligands for near IR emitting Ln3+ and red-emitting Eu3+ and Sm3+. Synthesis of extended terpyridine ligands will be conducted using Sonogashira and Suzuki-Miyaura coupling reactions. These terpyridine ligands will then be coordinated to Ln(β-diketonate)3 fragments. These bulky ligands will also sterically prevent high energy oscillators, such as OH bonds, from causing nonradiative emission. Synthesized molecular complexes will be structurally confirmed with single crystal XRD, FT-IR, UV-VIS spectroscopy, UV-Vis, and steady state & lifetime fluorimetry.

"Vibration Suppresssion through Adapative Input Shaping on the NASA LSMS"

Karan Baker | Louisiana State University and A&M College (LSU) | Space Grant - GSRA | Poster # 4
Presenting Team Members: Karan Baker, Mechanical Engineering

Due to the flexible nature of cable-driven autonomous systems, they are lightweight and modular in nature. However, this is a double-edged sword due to a vulnerability to vibrations. This work tackles this problem through the implementation of input shaping, a reference command design that instead breaks up the original command to eliminate vibrational poles that cause oscillatory behavior after a maneuver has completed. Because of the inherent nonlinearities and complexities of the LSMS, standard input shaper designs are not enough to completely eliminate vibrations that manifest from multiple poles, especially as the LSMS enters different configurations. Thus, utilizing camera-based detection of a payload can identify the system's vibrational tendencies and calculate input shaper parameters online to account for inaccuracies that the standard input shaper may falter to. The work presented displays the intended pipeline of system identification from camera observations, system parameter identification, and online input shaper implementation.

"Evolving Insights: Layering Complexity onto a Graph Theory Model of Student Interactions"

Nicole Biggs | Louisiana Tech University (LaTech) | Space Grant - GSRA | Poster # 5
Presenting Team Members: Nicole Biggs, Computational Analysis and Modeling PhD. Candidate

Effective teamwork is essential to the success of complex missions, yet it is not always clear how effective teams develop. This project builds on earlier exploratory work that used graph-based models to represent how students communicate during group work in first-year engineering courses. While those initial findings were promising, they captured only part of the picture. The current phase adds new layers of context and detail to the existing models,

with the goal of better understanding how communication relates to group effectiveness. Ultimately, this work aims to inform more intentional approaches to forming teams, with potential relevance to education and to collaborative settings beyond the classroom.

"Modeling Galactic Cosmic Radiation (GCR)-Induced Genomic Instability Using In Vivo CRISPR-Cas Genome Editing"

Katelyn Lofton | Louisiana State University Health Sciences (LSUHSC) | Space Grant - GSRA | Poster # 6
Presenting Team Members: Katelyn Lofton

Space exploration exposes astronauts to substantial environmental hazards, particularly galactic cosmic radiation (GCR) and microgravity, which pose significant risks to central nervous system integrity and function. Exposure to space radiation induces various forms of genomic damage, including DNA strand breaks, mutations, and chromosomal aberrations, some of which are difficult to repair. Among these lesions, DNA double-strand breaks (DSBs) are particularly consequential because of their potential to compromise genomic stability and trigger persistent DNA damage responses (DDRs). Although extensive correlative evidence links elevated DNA damage and dysregulated DDR signaling to aging and neurodegenerative disorders, a fundamental question remains: To what extent does DNA damage causally contribute to accelerated brain aging and possible neurodegenerative pathogenesis, particularly following exposure to space radiation?

A major obstacle to addressing this question is the lack of suitable in vivo tools capable of tracking DNA damage and its downstream consequences in neuronal populations with sufficient spatial and temporal resolution, sensitivity, and cell-type specificity. To overcome this limitation, our laboratory has developed a neurotropic, genome-editing-based approach that enables the targeted induction of DSBs across widespread regions of the adult mouse brain in a controlled, dose-dependent manner. This innovative platform allows us to generate persistent DSBs at the genomic safe-harbor locus Rosa26 in precisely controlled proportions of neuronal populations in vivo. By targeting a genomic locus selected to minimize disruption of essential gene functions, this strategy enables us to investigate the pathogenic consequences of persistent DNA damage and maladapt

"Reference Governor-Based Vibration Suppression for Safe and Precise Landing on NASA's STAR Testbed"

Sean Maki | Louisiana State University and A&M College (LSU) | Space Grant - GSRA | Poster # 7
Presenting Team Members: Sean Maki, Mechanical Engineering

This project will develop a reference governor for NASA's STAR robotic testbed to reduce vibrations during simulated landing trajectories. It will adjust commands in real time to satisfy vibration, acceleration, workspace, and tracking constraints. Simulation and a five-day visit to NASA Johnson Space Center will validate improved tracking and repeatability, supporting SPLICE precision landing technologies for lunar and planetary missions.

"Sustainable Rice Husk-Derived Lignin Coating for Lunar Regolith Abrasion Resistance"

Jermya Wilson | Louisiana Tech University (LaTech) | Space Grant - GSRA | Poster # 8
Presenting Team Members: Jermya Wilson, Molecular Science and Nanotechnology

Lunar regolith presents a materials durability challenge due to its abrasive particles and potential to damage exposed surfaces during lunar operations. This study investigates sustainable, rice husk-derived lignin-silica hybrid coatings as potential protective materials for applications involving lunar regolith exposure. Lignin was extracted from rice husk using a natural deep eutectic solvent (NADES) and incorporated into a silica-based coating formulation using tetraethyl orthosilicate (TEOS). Two coating formulations were developed: an acid-catalyzed system incorporating acetic acid and a non-acid-catalyzed system. The coatings were applied to carbon steel substrates and thermally cured. Following initial characterization, coated specimens underwent environmental conditioning under vacuum, while control specimens were maintained under open-hood conditions. The specimens were subsequently subjected to high-velocity lunar regolith blasting to simulate particle impact on exposed surfaces. Post-exposure characterization was performed to assess changes in coating properties and evaluate the effects of environmental conditioning and regolith impact on coating integrity. Comparing the two catalytic formulations under these conditions provides insight into the influence of acid catalysis on coating performance and durability. This work combines agricultural waste valorization with hybrid coating development to investigate a potentially sustainable approach to surface protection for lunar exploration. The findings may inform the development of protective coating systems designed to withstand the demanding environmental and particulate conditions associated with lunar operations.

"Entropy-Enhanced Fault Classification in Space-Based Power Systems"
Md Khairul Islam | University of Louisiana at Lafayette (ULL) | EPSCoR - RAP | Poster # 9
Presenting Team Members: Md Khairul Islam, PhD in Systems Engineering (Electrical Engineering Concentration)

Autonomous fault recognition is increasingly important for space-based power systems, where maintenance access is limited, and communication with ground operators may be delayed. Conventional statistical descriptors can characterize signal magnitude and distribution, but they may overlook changes in irregularity, complexity, and temporal behavior caused by faults. To address this limitation, a broad set of 25 entropy-based descriptors is examined together with conventional statistical features for three fault categories: regulator, sensor-noise, and high-impedance faults. The entropy measures are compared through five complementary separability criteria, and multiple raw, entropy-only, and combined feature sets are evaluated using Random Forest, Linear SVM, Gradient Boosting, and Multilayer Perceptron classifiers. Validation is performed at the signal level so that samples derived from the same original signal are kept within a single data partition. The combined raw and entropy representation provides the strongest classification performance, while a reduced entropy subset retains nearly the same accuracy with fewer features. These findings suggest that entropy-based descriptors can enrich conventional fault features and support more compact and reliable diagnostic models for space power-system applications.

"Precision Motion Control for the NASA LSMS Crane Across Variable Payload Operations"
Sanjay Maharjan | Louisiana State University and A&M College (LSU) | EPSCoR - RAP | Poster # 10
Presenting Team Members: Animesh Bangal, Mechanical Engineering

This project will develop input-shaping strategies to suppress vibrations and improve precision on NASA's Lightweight Surface Manipulation System (LSMS) while preserving its existing controllers. Research includes dynamic modeling, system identification, command design, and experimental validation at NASA Langley using ROS 2. Outcomes will support safer, more accurate payload handling, construction, and logistics for Artemis missions.

"Size-Controlled Fe_3O_4 Nanoparticles Designed by Response Surface Methodology to Enhance Bioethanol Production from Hydrothermal Carbonization Liquor"

Abbas Abubakar | Louisiana Tech University (LaTech) | EPSCoR - RAP | Poster # 11
Presenting Team Members: Abbas Abubakar, PhD Molecular Science and Nanotech; Jermya Wilson, PhD Molecular Science and Nanotech

Iron oxide nanoparticles (NPs) can enhance microbial fermentation; however, their effects depend strongly on particle size and dosage, so reproducible synthesis control is essential. In this study, we synthesized Fe_3O_4 NPs via the alkaline co-precipitation of Fe^{2+}, with controlled partial oxidation using NaOH. We used response surface methodology (RSM) with a central composite design (CCD) to optimize four factors-reaction temperature, reaction time, pH, and total iron concentration-to maximize particle size. Analysis of variance (ANOVA) indicated that the quadratic model provided a good fit (R^2 = 0.9019, adjusted R^2 = 0.8104, lack-of-fit p = 0.9820). The predicted optimum conditions (5 g/L iron, pH 10, 60 min, and 60 °C) yielded NPs measuring 30 ± 1 nm by SEM, closely matching the predicted size of 29.9 nm. FT-IR showed Fe-O bands; SEM revealed quasi-spherical particles; and EDS confirmed Fe and O as the principal elements. XRD analysis is underway to confirm the inverse spinel magnetite phase, and TEM analysis of the size distribution is also in progress. This framework provides a reproducible method for producing size-tuned Fe_3O_4 NPs and establishes a basis for evaluating their size- and dose-dependent effects on microbial fermentation.

Keywords: magnetite nanoparticles; response surface methodology; central composite design.

"A Haptic Teleoperation Framework for Space Construction: Performance Assessment of Kinematic and Visual Assistive Functions"

Aras Maqsoodi | Louisiana State University and A&M College (LSU) | EPSCoR - RAP | Poster # 12
Presenting Team Members: Aras Maqsoodi, Construction Management/Computer Science; Carlos Luis Manosalvas Holst, Computer Science

Telerobotics research in construction has primarily focused on excavating, while other important tasks requiring high precision and tracing motions, such as the repair and fabrication of infrastructure in space and other extreme environments, remain comparatively underexplored. Such tasks demand specialized manipulation and feedback modalities to support effective human-robot teaming, especially when operators work at a distance from the site, as in space operations. This study investigated a haptic interface augmented with assistive kinematic and graphical functions to support efficient and safe execution of such remote tasks. Three teleoperation scenarios were evaluated: a baseline, one supported by assistive kinematic functions, and one supported by both assistive control functions and graphical aids. A human-subject study was conducted to systematically assess operator performance and human factors across scenarios. Both objective performance metrics (task completion time,

cartesian trajectory values, and collision counts) and subjective user experience measures were analyzed. The results demonstrate that the proposed assistive functions significantly improve precision (88%), operational efficiency (63%), and collision-free manipulation (75%) during the simulated telerobotic crack repair tasks while also reducing mental demand and improving the perceived usability. These findings may inform teleoperated space construction and maintenance of space infrastructure, such as lunar and planetary surface systems, where human presence is costly or unsafe.

"Beyond Forecast Accuracy: Satellite-Enhanced Solar Prediction for Microgrid Battery Planning"
Md Rafiqul Sarker | University of Louisiana at Lafayette (ULL) | EPSCoR - RAP | Poster # 13
Presenting Team Members: Md Khairul Islam, PhD in Systems Engineering (Electrical Engineering Conc.)

Solar irradiance forecasts are typically evaluated by average error, yet battery reserve planning in solar-coupled microgrids depends more on large overestimation errors. This study evaluates whether GOES-16 satellite cloud optical depth (COD) observations, fused with ground-based irradiance measurements, improve 30-minute-ahead solar forecasts at a microgrid site in Crowley, Louisiana, using one year (2021) of data. A satellite-enhanced (fusion) LightGBM model is compared against smart persistence and a ground-only LightGBM model. Over the test period, the fusion model achieves an RMSE skill of 7.2% over smart persistence, while the ground-only model scores −12.0%, indicating that the gain comes from the satellite data rather than the learning algorithm. On high-variability days, skill rises to 20.8%. The fusion model's mean absolute error is slightly higher than persistence; its gains are concentrated in large errors. Relative to smart persistence, it reduces a 95th-percentile reserve requirement proxy by approximately 49% on high-variability days and a cumulative shortfall-energy proxy by 44% overall. These results show that satellite cloud observations can improve the planning value of solar forecasts even when mean absolute error does not improve.

"Dynamical Horizons and Unidirectional Transport without Driving"
Valeriia Bilokon | Tulane University (Tulane) | EPSCoR - RAP | Poster # 14
Presenting Team Members: Valeriia Bilokon, Physics; Elvira Bilokon, Physics

Black holes permit matter to cross their event horizon in only one direction. We show that interacting bosons in optical lattices with asymmetric barrier exhibit an analogous phenomenon, creating unidirectional quantum transport without external driving or dissipation. This directionality emerges purely from many-body interactions, which cause asymmetric projection of the initial state onto transport-enabled or transport-forbidden sectors. The resulting dynamics create an effective one-way boundary in Hilbert space, forming a quantum analog of a black-hole event horizon. Our results establish interactions as a fundamentally new route to directional transport, enabling coherent rectification in atomtronic circuits by the use of intrinsic properties of the system only.

"Benchmarking Deep Learning and Spectral Foundation Models for Water-Quality Retrieval Using GLORIA and PACE OCI"
Mizbah Ahmed Sresto | Louisiana State University and A&M College (LSU) | EPSCoR - RAP | Poster # 15

Presenting Team Members: Mizbah Ahmed Sresto; Peng Fu Major: Plant, Environmental and Soil Sciences (SPESS)

Coastal and inland waters are optically complex because phytoplankton, colored dissolved organic matter (CDOM), and suspended particles produce overlapping spectral signals. These overlapping signals make it difficult to separate their effects on reflectance and accurately retrieve water-quality parameters across diverse water bodies. This research uses parameter-specific subsets of the GLObal Reflectance Community Dataset for Imaging and Optical Sensing of Aquatic Environments (GLORIA), which contains 7,572 hyperspectral reflectance spectra from 450 water bodies. The study retrieves chlorophyll-a (Chl-a), CDOM absorption at 440 nm (aCDOM 440), and total suspended solids (TSS). Among the three water quality parameters, Chl-a has directly comparable PACE Level 2 products. PACE provides the combined absorption coefficient of CDOM and non-algal particles (adg), rather than GLORIA-equivalent CDOM absorption at 440 nm and provides no direct TSS product. Building upon this, the study benchmarks chlorophyll-a retrieval against the operational PACE product and develops complementary retrievals for $aCDOM(440)$ and TSS using Mixture Density Network (MDN) as a baseline model, Hyper-MoE-VAE as a deep learning model, and HyperSL as a hyperspectral foundation model. To ensure model generalization, data from selected lakes and regions are withheld from training and used only for testing. Model performance will be evaluated using R^2, RMSE, MAE, bias, and uncertainty calibration. For satellite-level validation, water-quality estimates derived from PACE OCI remote-sensing reflectance will be compared with spatially and temporally matched SeaBASS in situ measurements, where sufficient matchups are available. Finally, the best-performing model will be applied to selected PACE scenes

"From Orbit to Atmosphere: Exploring the Potential Environmental Impacts of Satellite Reentry"
Guolong Li | Tulane University (Tulane) | EPSCoR - RAP | Poster # 16
Presenting Team Members: Guolong Li, Earth and Environmental Science

The rapid growth of low-Earth-orbit satellite megaconstellations is expected to increase spacecraft reentries and the release of metals into the upper atmosphere. Aluminum and its alloys account for approximately 36.7% of a representative satellite's mass, and spacecraft-derived metals have been detected in 10 ± 7% of stratospheric sulfuric-acid particles larger than 120 nm. Reentry-generated alumina (Al2O3) aerosols may also promote heterogeneous chemical reactions that activate chlorine and potentially contribute to ozone depletion.

In this study, we use CESM-WACCM to investigate the atmospheric transport of reentry-derived Al2O3 under a prescribed emission scenario of 237 metric tons per year at altitudes of 60-80 km. Three aerosol size modes are considered: Aitken (8.7-52 nm), accumulation (53.5-480 nm), and coarse (0.4-40 μm). Preliminary simulations show that particles in all three modes descend from the mesosphere into the stratosphere, with larger particles exhibiting deeper downward transport. In particular, coarse-mode particles can reach the troposphere. These results highlight the importance of particle size in determining the atmospheric fate of satellite-reentry aerosols and provide a foundation for assessing their potential environmental impacts.

"LaACES DemonSats-7 Payload Experiment: Exploring Airflow Dynamics of Sounding Balloon Flight"
Anna Dugas | Northwestern State University of Louisiana (NSULA) | Space Grant - LaACES | Poster # 17
Presenting Team Members: Brendan Donaghy, NSU Electronic Engineering Technology; Eben Dorris, LSMSA

High School; Noah Schleifstein, LSMSA High School; Sean Song, LSMSA High School; Danny Ye, LSMSA High School; Anika Chegireddy, LSMSA High School; Anna Dugas, NSU Physical Sciences

The NSULA/LSMSA DemonSats-7 (DS-7) mission was developed to investigate atmospheric conditions and airflow dynamics during a high-altitude balloon flight to approximately 100,000 ft (30,480 m). The payload was designed to measure atmospheric pressure, temperature, humidity, and wind speed as functions of altitude while evaluating airflow behavior both around and within a hexagonal payload enclosure.

DS-7 utilizes a Mini-MegaSat platform incorporating an Arduino Mega, Adafruit Ultimate GPS module, and a suite of calibrated environmental sensors. A lightweight hexagonal foam enclosure was selected to promote more uniform airflow and pressure distribution, as predicted through computational fluid dynamics (CFD) modeling. The payload also includes a vertical pass-through column equipped with miniature anemometers to measure internal airflow, while additional anemometers mounted externally characterize airflow around the payload. The use of three wind sensors allows comparison of sensor placement strategies and evaluation of optimal configurations for future atmospheric balloon missions.

Prior to flight, all sensors were calibrated to ensure accurate analog-to-digital measurement conversion. The payload was designed to meet Louisiana Aerospace Catalysts Experiences for Students (LaACES) requirements for mass, dimensions, and flight vehicle integration. Thermal and vacuum testing verified payload survivability and sensor operation under expected stratospheric conditions.

Flight data from ACE-75 launched on May 19, 2026, was used to develop atmospheric profiles of pressure, temperature, humidity, and air speed with altitude. Internal and external airflow measurements were compared. Results improved understanding of payload aerodynamics and support the design of future student projects.

"Development of a LaACES Balloon Payload for Atmospheric Data Collection and Analysis"
Solida Tan | McNeese State University (McNeese) | Space Grant - LaACES | Poster # 18
Presenting Team Members: Rohitpreet Singh, Computer Science; Kate Turner, Computer Engineering

The main goal of this project is to design and implement a LaACES balloon payload to collect atmospheric data, such as temperature, humidity, and air pressure, and to analyze the collected data. The project will provide engineering and computer science students at McNeese State University with hands-on experience in electronics, thermal and vibration isolation, circuit design, programming, project management, experimental design, and data collection and analysis.

"Development of a LaACES Balloon Payload for Atmospheric Data Collection and Analysis"
Rohitpreet Singh | McNeese State University (McNeese) | Space Grant - LaACES | Poster # 19
Presenting Team Members: Solida Tan , Computer science; Kate Turner, computer engineering

The main goal of this project is to design and implement a LaACES balloon payload to collect atmospheric data, such as temperature, humidity, and air pressure, and to analyze the collected data. The project will provide engineering and computer science students at McNeese State University with hands-on experience in electronics,

thermal and vibration isolation, circuit design, programming, project management, experimental design, and data collection and analysis.

"2025-2026 Krewe of Balloon Atmospheric Data Acquisition"

Deirdre Murphy | Loyola University (Loyola) | Space Grant - LaACES | Poster # 20
Presenting Team Members: DD Murphy, Physics; Tomasso Fennell, Biophysics

The LaACES team from Loyola University New Orleans (Krewe Of Balloon) designed and built a payload for a high-altitude weather balloon flight. The payload records GPS position and time, internal and external temperature, pressure, humidity, and solar irradiance, with the goal of measuring how irradiance changes with altitude. Temperature sensors were calibrated in a water bath with linear regression most challenging aspect was obtaining accurate irradiance readings, because the payload spin during ascent. To address this, an MPU-9250 (gyroscope, accelerometer, and magnetometer) feeds a Madgwick filter that estimates the payload's 3D orientation. With this data, a program was written to adjust the data collected from the 4 solar irradiance sensors and record the most accurate data set.

"Temperature Sensor Calibration for a Silicon Diode"

Tomasso Fennell | Loyola University (Loyola) | Space Grant - LaACES | Poster # 21
Presenting Team Members: Tomasso Fennel, Biophysics; DD Murphy, Physics; Tazia Reid, Neuroscience; Morgan Laneair, Neuroscience; Santi Macias, Computer Science; Beau Barrosse, Physics; Conor Taft, Physics Pre-Engineering; Dereion Robertson, Physics Pre-Engineering; Cesar Rey

The LaACES team at Loyola University New Orleans has constructed temperture sensors using a silicon diode. Sensorer were then tested using a water bath. This activity was preformed as practice for working with linear regression calibration equations for the 2026-2027 payload.

To confirm the sensors functionality, team initially constructed and tested the sensors on a breadboard. At room temperature the diode's forward voltage about 0.7V, and dropped to about 0.3V in warm water. After this intial test, the sensors were soldered onto a PCB and carried out the proper testing for calibration. Output voltage was recorded across five or more data points, taken within a range on 0-50 C°; then used to create a calibration equation. The settings on the potentiometers were then readjusted to align with the results of the calibration equation.

"Battery Operation Informed Temperature Prediction for Cooling-Aware Microgrid Day-Ahead Scheduling"

Jose Betancourt | McNeese State University (McNeese) | EPSCoR - Other | Poster # 22
Presenting Team Members: Jose Betancourt, Electrical Engineering

High renewable penetration in microgrids increases variability and operational uncertainty, making Battery Energy Storage Systems (BESS) central to balancing supply and demand, providing reserves, and improving reliability.

Traditional day ahead schedules (TDAS) typically model BESS as an electrical only resource with fixed efficiency, power limits, and state-of charge (SoC) bounds, overlooking battery thermal dynamics and the electricity required for cooling. This omission can steer the dispatch toward options that look cheap on paper but hide the real costs of thermal management. In this paper, a cooling-aware aware day-ahead scheduling (CDAS) framework that embeds a data driven BESS temperature predictor and associated cooling-power model into the economic dispatch is proposed. First, a deep neural network (DNN) trained on real operational data forecasts BESS temperature is developed. Second, predicted temperatures parameterize a cooling-power calculation that is integrated into the DAS, ensuring the plan internalizes the electrical cost of thermal management while respecting equipment and reliability constraints. Furthermore, this paper compares the resulting schedule against a conventional electrical-only baseline to assess impacts on projected cost, feasibility, and operating profiles. The approach provides a practical pathway for aligning microgrid planning with the physical realities of BESS operation, improving dispatch realism without sacrificing tractability.

"Development of an Automated Image-Processing Framework for Thermophysical Property Characterization Using Electrostatic Levitation"

Mootaz Anany | University of Louisiana at Lafayette (ULL) | EPSCoR - Other | Poster # 23
Presenting Team Members: Mootaz Anany

Accurate characterization of thermophysical properties is essential for understanding the behavior of high-temperature alloys and advancing materials processing and manufacturing technologies. Electrostatic Levitation (ESL) enables containerless experimentation by suspending and melting metallic samples under vacuum, minimizing contamination and allowing the investigation of liquid metals at elevated temperatures. However, extracting thermophysical properties from high-speed experimental recordings often requires extensive manual processing, specialized computational tools, and multiple analysis procedures.

This research focuses on developing an automated, Python-based computational framework for processing ESL experimental data and characterizing the thermophysical properties of metallic alloys. The framework integrates image processing, droplet detection, geometric measurements, oscillation analysis, and synchronized temperature data to support the determination of key properties, including density, surface tension, and viscosity. Experimental datasets obtained from ESL investigations of Fe-Si and Nb-based alloys at NASA Marshall Space Flight Center provide the foundation for framework development and validation.

The proposed approach aims to improve computational efficiency, reproducibility, and consistency while reducing manual intervention in experimental data analysis. By establishing a scalable and accessible analysis framework, this research seeks to facilitate thermophysical characterization and support future integration with predictive computational models for advanced materials development and space manufacturing applications.

"From Data to Decisions: Improving NASA Disaster Response Operations"

Leslie Ward | Louisiana State University and A&M College (LSU) | Internship | Poster # 24
Presenting Team Members: Leslie Ward, Geography and Economics

The NASA Disasters Response Coordination System (DRCS) leverages Earth science and technological expertise to provide actionable information to organizations responding to disasters across the United States. During the internship period, the DRCS supported eight disaster activations, including wildfires, floods, an earthquake, and Super Typhoon Bavi. Geospatial and operational analyses identified opportunities to improve data review, performance measurement, stakeholder communication, and product consistency.

A standardized quality assurance and quality control workflow was developed, including a detailed checklist defining expectations for validating and publishing DRCS products. Activation decision guidance was also expanded to promote more consistent and timely decisions. To improve performance measurement, the DRCS SharePoint dashboard was enhanced to centralize key metrics and automate data collection and analysis, providing both high-level summaries and detailed data views.

To clarify stakeholder expectations, hazard-specific activation timelines and use-case materials were developed to demonstrate how DRCS products support emergency response. Finally, standardized metadata guidance and reusable templates were created for commonly produced products. These templates provide essential information about product purpose, limitations, and appropriate use, improving accessibility for end users with limited GIS or remote sensing experience.

Together, these improvements establish more consistent operational processes, increase transparency in decision-making, reduce manual data processing, and improve the clarity and usability of DRCS products during disaster response.

"Manufacturing Engineering in Aerospace: Propellant Tank Production and Assembly"

Jacob Harding | Louisiana State University and A&M College (LSU) | Space Grant - Internship | Poster # 25
Presenting Team Members: Jacob Harding, Mechanical Engineering

During the summer of 2026, I worked as a Manufacturing Engineering Intern with Vivace at NASA's Michoud Assembly Facility, supporting the manufacturing and assembly of aerospace propellant tanks. Throughout the internship, I gained practical experience with manufacturing processes, production planning, and the engineering considerations involved in large scale aerospace structures. My work focused on supporting the propellant tank build sequence while developing a better understanding of how engineering designs are translated into physical components. This experience strengthened my technical knowledge, problem-solving abilities, and understanding of manufacturing engineering within the aerospace industry.

"Thermal-Structural Analysis of a Heat Exchanger Housing Using NASTRAN"

Brennon Stevens | Louisiana State University and A&M College (LSU) | Space Grant - Internship | Poster # 26
Presenting Team Members: Brennon Stevens, Mechanical Engineering

This project explores the application of Finite Element Analysis (FEA) using MSC NASTRAN to evaluate the structural and thermal performance of a heat exchanger housing-a critical component in aerospace environmental control systems. Recognizing the complex thermal gradients and mechanical loads these housings endure, the

primary objective of this internship was to build, calibrate, and analyze a representative simulation model to predict stress and temperature distributions.

The work involved transitioning from CAD geometry to a meshed finite element model, applying appropriate thermal boundary conditions (convective heat transfer, internal fluid temperatures) and structural constraints. Under various simulated operating environments, NASTRAN's solver was utilized to analyze thermal-induced expansion, thermal stress, and structural integrity. Through an iterative process of refining mesh density, applying material properties, and resolving convergence issues, the project served as a comprehensive evaluation of NASTRAN's workflow and capabilities. The findings of this study demonstrate the critical role of FEA in identifying high-stress concentration areas and optimizing the thermal-mechanical resilience of flight-hardware housings, while establishing a foundational framework for future modeling and simulation tasks within Lockheed Martin's design pipeline.

"Cislune: Advancing Lunar Exploration Through Robotics, Engineering, and Resource Utilization"

Aanooalii Filoialii | Louisiana State University and A&M College (LSU) | Space Grant - Internship | Poster # 27

Presenting Team Members: Aanooalii Filoialii, Mechanical Engineering; Claire Bonius, Computer Science

Establishing a sustained human and robotic presence on the Moon requires technologies capable of excavating, transporting, processing, and reusing local materials. Cislune develops lunar surface infrastructure through mechanical engineering, robotics, resource recovery, simulation, and experimental testing. This poster provides an overview of the company's multidisciplinary technology portfolio, informed by a summer engineering internship.

Featured programs include PERDEX, which develops and tests hardware for excavating ice-bearing lunar regolith; CISORT, which explores regolith beneficiation, mineral separation, and vertical material conveyance; and TREAD and GRASP, which address wheel-soil interaction and surface compaction. Additional efforts include the CARVE rover and SimMoon simulation environment for lunar operations, as well as CRAFTER, a recycling and resource-recovery system recognized in NASA's LunaRecycle Challenge. Across these programs, engineers use computer-aided design, fabrication, controls, materials testing, and prototype evaluation to move concepts toward practical demonstrations.

Together, these efforts demonstrate how integrated lunar excavation, mobility, processing, and autonomy technologies can support in-situ resource utilization (ISRU) and help enable more sustainable lunar exploration. The poster also highlights engineering processes, testing methods, and lessons observed during the internship.

"Mechanical Engineering Applications In Spacecraft Thermal Management, Structural Design, and Manufacturing"

Gavin Peters | Louisiana Tech University (LaTech) | Space Grant - Internship | Poster # 28

Presenting Team Members: Matthew Gatz, Mechanical Engineering; Riley Ovalle, Mechanical Engineering

Gavin Peters, Mechanical Engineering

Spacecraft thermal management and structural integrity are critical to the performance and reliability of spaceflight hardware. During a mechanical engineering internship with Lockheed Martin Space at NASA's Stennis Space Center, several engineering projects were undertaken to support thermal hardware development, structural optimization, and manufacturing processes. Work included supporting the thermal evaluation of six ammonia-charged heat pipes through life testing and data acquisition using thermocouples, as well as developing a parametric 3-D heat pipe model in Creo using derived trigonometric relationships to automate geometry changes based on fin count. Additional efforts focused on a spacecraft radiator design utilizing structural, thermal, and vibro-acoustic analyses in Siemens NX, with design iterations evaluated against stiffness, structural safety, and mass constraints. Improvements to manufacturing and testing included developing a procedure for compression molds for heat pipe microstructural analysis and designing a 3-D printed tool to consolidate cables in the workspace. Our work highlights the importance of integrating modeling, testing, and manufacturing to support spaceflight systems and improve efficiency.

"Quality Engineering and Manufacturing Processes in Aircraft Exterior Production"

Gabriel Lamperez | Tulane University (Tulane) | Space Grant - Internship | Poster # 29
Presenting Team Members: Gabriel Lamperez, Engineering Physics

During the summer of 2026, I interned as an Engineering Intern at AVEX Aviation Exteriors at Acadiana Regional Airport in New Iberia, Louisiana. I supported the engineering department by identifying and documenting aircraft damage and repairs reported by the Quality team. I also contributed to the development of an in-house aircraft placard manufacturing process. This work involved selecting appropriate materials, obtaining and reviewing material testing documentation, creating schematics for individual placards, and presenting the proposed process for review and approval. Throughout the internship, I gained experience with nondestructive testing (NDT) methods used in aircraft inspection, General Maintenance Manual (GMM) procedures for documenting damage and identifying repair solutions, and the regulatory requirements governing aircraft maintenance, repair, and overhaul (MRO) operations.

"Rotary Kiln Test Stand Reactivation & NOVA: AI Document Processing System"

Vinh Bui | Louisiana State University and A&M College (LSU) | Space Grant - Internship | Poster # 30
Presenting Team Members: Vinh Bui, Chemical Engineering

At NASA Marshall Space Flight Center, this project focused on improving life-support technologies for future space missions by recovering oxygen and water from metabolic waste. The primary work involved reactivating a Rotary Kiln Test Stand for carbon formation research within the Bosch process. Responsibilities included updating P&IDs, integrating oxygen and hydrogen safety sensors, revising operating procedures, and preparing instrumentation documentation for future automation.

In parallel, I developed NOVA, an AI-assisted document processing system that improves the organization, retrieval, and validation of legacy Environmental Control and Life Support Systems (ECLSS) records through OCR, automated document classification, and confidence-based review.

"Manufacturing Engineering Internship at Vivace International: COPV Production and X-Ray Inspection Tooling Design"

Abigail Peck | Louisiana State University and A&M College (LSU) | Space Grant - Internship | Poster # 31
Presenting Team Members: Abigail Peck, Mechanical Engineering

During Summer 2026, a 10-week Manufacturing Engineering Internship was completed at Vivace International, located at NASA's Michoud Assembly Facility, through the LaSPACE Industry Internship Program. The internship focused on gaining hands-on experience with the manufacturing of composite overwrapped pressure vessels (COPVs) and understanding the responsibilities of manufacturing engineers throughout aerospace production.

Experience was gained across multiple stages of COPV manufacturing, including welding, surface preparation, composite wrapping, testing, and quality inspection. Particular emphasis was placed on composite manufacturing, including fiber preparation, winding equipment operation, process documentation, and troubleshooting. Additional responsibilities included developing manufacturing work instructions and production trackers to support hardware processing and coordination.

A major individual project involved the design and fabrication of an adjustable cart for COPV X-ray inspection. The project progressed from identifying inspection requirements and developing SolidWorks models through multiple design revisions, component procurement, machining, and implementation. The completed cart was successfully used during X-ray inspection, and the engineering drawing package was formally released.

Together, these experiences demonstrated the relationship between engineering design, manufacturing operations, and quality assurance in aerospace hardware production. The internship strengthened technical and professional skills while providing a broader understanding of manufacturing engineering in the aerospace industry.

"Coastal Wetland Aboveground Biomass Mapping Using Earth Observation Foundation Models"

Shuqi Wu | Louisiana State University Agricultural Center (LSU-Ag) | Space Grant - Other | Poster # 32
Presenting Team Members: Shuqi Wu, Precision Agriculture; Chi Qiu, Precision Agriculture; Sresto Mizbah, Precision Agriculture

Aboveground biomass (AGB) in coastal wetlands is an important indicator of vegetation condition and aboveground carbon stocks. However, complex vegetation communities, land-water transitions, and mixed pixels pose challenges for traditional AGB estimation methods based on pixel-level spectral information. Earth observation (EO) foundation models learn spectral-spatial representations through large-scale pretraining, offering new opportunities for quantitative AGB estimation. Nevertheless, the predictive value of these representations and their applicability across different reference datasets and observation scales remain to be evaluated. This study focuses on coastal wetlands in Louisiana, USA, and employs Clay v1.5 to extract pretrained spatial representations for developing a pixel-level AGB estimation framework. The study aims to evaluate the applicability of pretrained EO representations and spatial decoding strategies for quantitative AGB estimation in coastal wetlands, providing a methodological foundation and data resources for regional wetland biomass monitoring and subsequent analyses of its relationships with environmental factors.

"Evaluating the Relationship Between Formaldehyde Levels and Environmental Factors (Wind and Temperature) Near Xavier University of Louisiana (2024)"

Kaylin Allen | Xavier University of Louisiana (Xavier) | Space Grant - Other | Poster # 33
Presenting Team Members: Kaylin Allen, Dual Degree Biomedical Engineering; Paige Walls, Dual Degree Biomedical Engineering

This ongoing study investigates the relationship between tropospheric formaldehyde (HCHO) concentrations and meteorological factors, including wind, temperature, and cloud cover, in the urban environment surrounding Xavier University of Louisiana in New Orleans. The study also examines temporal variations in formaldehyde concentrations to better understand how HCHO levels change over time. Tropospheric formaldehyde measurements were obtained using a NASA Pandora Spectrometer System, while meteorological data were retrieved from NASA's Giovanni online data analysis tool. Data collected during 2024 were used to examine relationships between formaldehyde concentrations and the selected meteorological variables, as well as to investigate temporal patterns in HCHO concentrations. The study aims to improve our understanding of how meteorological conditions are associated with formaldehyde levels in an urban environment.

"Saharan Dust Over New Orleans"

Xavier Musquiz | Xavier University of Louisiana (Xavier) | Space Grant - Invitation | Poster # 34
Presenting Team Members: Xavier Musquiz, Dual Degree Physics and Mechanical Engineering

This project investigates the optical and physical properties of Saharan dust after its trans-Atlantic transport from West Africa to New Orleans, Louisiana. Using data from the Aerosol Robotic Network (AERONET), the study analyzes aerosol optical depth (AOD), Ångström exponent (AE), single scattering albedo (SSA), and volume size distribution (VSD) to identify potential Saharan dust events and examine changes in aerosol characteristics. These parameters provide insight into aerosol loading, particle size, light scattering and absorption, and particle composition. By comparing AERONET measurements from stations along the transport pathway, this research aims to investigate how the optical and physical properties of Saharan dust evolve as the particles travel from West Africa across the Atlantic Ocean to New Orleans.

"Investigating Nitrogen Dioxide Variability and Meteorological Influences in New Orleans, Louisiana"

Oluwatobiloba Adejumo | Xavier University of Louisiana (Xavier) | Space Grant - Invitation | Poster # 35
Presenting Team Members: Oluwatobiloba Adejumo, oadejumo@xula.edu

Nitrogen dioxide (NO_2) is an atmospheric pollutant primarily associated with fossil fuel combustion, transportation, and industrial activities. Understanding its temporal variability and the environmental factors influencing its concentration is important for assessing urban air quality. This ongoing study investigates the variations, potential sources, and meteorological influences on NO_2 in New Orleans, Louisiana, using observations from a Pandora spectrometer located at Xavier University of Louisiana. Measurements collected between May 31, 2024, and September 26, 2026, were analyzed alongside historical wind speed and direction data obtained from Open-Meteo. Quality-controlled measurements were analyzed alongside wind speed and direction data from Open-Meteo to investigate diurnal, weekly, and seasonal patterns and the relationship between surface NO_2

concentrations and tropospheric vertical column densities. Preliminary results reveal distinct daily variations, with surface NO_2 concentrations generally peaking in the early morning and tropospheric column densities increasing toward the evening. Weekday tropospheric NO_2 levels were generally higher than weekend levels, suggesting a possible influence from human activities, including traffic and other combustion-related emissions. Wind-direction analysis also indicates elevated NO_2 column densities during southwesterly winds, suggesting that pollutant transport may contribute to observed concentrations. Additionally, a positive relationship was observed between surface NO_2 concentrations and tropospheric column densities, although considerable variability remains.

"Effects of Heavy Metal Exposure from Wetland Pollutants on Brain Glutamate Levels in Mice"

Josephine Day | Louisiana Tech University (LaTech) | Space Grant - LASSO | Poster # 36
Presenting Team Members: Josephine Day, Biomedical Engineering

Cadmium (Cd) and lead (Pb) are toxic heavy metals that have contaminated Louisiana wetlands for decades due to industrial activities and improper waste disposal, posing significant environmental and public health concerns. These persistent pollutants accumulate in soil, water, and aquatic organisms, threatening wetland ecosystems and fish and shellfish species. In addition to their environmental impact, Cd and Pb exposure presents serious health risks. Consumption of contaminated seafood can result in acute symptoms such as headaches and gastrointestinal distress, while long-term exposure can lead to organ damage and neurological dysfunction. Children are particularly vulnerable to Pb toxicity, which can impair cognitive development. Both Cd and Pb can cross the blood-brain barrier and disrupt glutamatergic signaling, a critical pathway involved in learning, memory, and neuronal communication. Excessive glutamate (GLU) levels can induce excitotoxicity, resulting in neuronal injury and potentially irreversible neurological damage. This study aims to investigate the chronic effects of Cd and Pb exposure on GLU concentrations in the mouse brains and to evaluate the dose-dependent relationship between heavy metal exposure and GLU elevation. Mice will be exposed to varying concentrations of Cd or Pb through their drinking water for four weeks. Following exposure, GLU levels will be measured using flexible, enzymatically functionalized microelectrode arrays (MEAs) previously developed by our research group. The findings from this research will improve our understanding of the neurological consequences of heavy metal exposure and contribute to the fields of environmental toxicology and bioengineering while advancing the development of electrochemical sensing technologies.

"Impact of nickel on exoskeletal mineralization in the post-ecdysial blue crab, Callinectes sapidus"

Mia Wright | Nicholls State University (Nicholls) | Space Grant - LASSO | Poster # 37
Presenting Team Members: Mia Wright, Biology/Pre-Med

The explosion of the Deepwater Horizon oil rig on April 20, 2010 resulted in a massive oil spill in the northern Gulf of America (NGA), with the Louisiana coastal environment being the most severely impacted. In the ensuing years, a large volume of investigations have been carried out to study the impact of this massive oil spill on the NGA fauna. However, little attention has been paid to the adverse effects of heavy metals contained in the oil spill on marine and coastal organisms. This project is proposed to investigate the impact of nickel, a heavy metal conspicuously present in the BP Macondo crude on post-ecdysial exoskeletal mineralization in the blue crab, Callinectes sapidus, a keystone species as well as a commercially important crustacean. Because nickel ion is similar to calcium ion in

that both are divalent cations, it is hypothesized that nickel treatment would result in incorporation of nickel into the exoskeleton, thereby disrupting post-ecdysial exoskeletal mineralization in blue crabs. Two groups of ten one-day post-ecdysial blue crabs each will be injected with an environmentally relevant nickel dose of 10 µg/g wet weight and Pantin's crustacean saline, respectively, at days 1 and 3. At day 5, all the survivors will be sacrificed for carapace and soft tissue collection. ICP-OES will be used for quantification of nickel, calcium and magnesium in the shell and various soft tissues. The finding of this project will expand the understanding of BP oil spill impacts on marine and coastal fauna.

"Additively manufactured motion activated bistable and self-deployable auxetic metamaterials"

Evan Simon | Southeastern Louisiana University (SELU) | Space Grant - REA | Poster # 38
Presenting Team Members: Christian Rust, Mechanical Engineering Technology; Evan Simon, Mechatronics Engineering Technology

Auxetic materials, a class of materials with counterintuitive deformation behavior, where the materials expand laterally when they are stretched longitudinally and contract when they are contracted, possess a series of unique characteristics that are attributed to their inherent negative Poisson's ratio. These include improved energy absorption, fracture toughness, shear resistance, indentation resistance, and acoustic performance. NASA has been actively evaluating additive manufacturing (AM, also known as 3D printing) technologies for off-earth manufacturing purposes. Among these technologies, material extrusion-based AM has been demonstrated to be robust enough to be used in microgravity environment for in-space manufacturing. NASA also plays a pioneering role in developing deployable systems and structures for a wide range of space applications. Current and future NASA missions can significantly benefit from the development of compact, lightweight, and deployable structures and systems of all kinds of materials, shapes, and sizes. Therefore, additively manufactured bistable and self-deployable auxetic metamaterials provide an opportunity to explore their potential to improve space utilization of payload for energy absorbing structures (e.g., cushion, packaging, etc.). In this proposed research project, the researchers will conceptualize and design novel bistable and self-deployable structures that demonstrate negative Poisson's ratio, simulate the bistable and deployable mechanisms using finite element analysis, 3D print the auxetic metamaterials, demonstrate their bistable state and deployable capability, and test their mechanical properties for repeated applications.

"Robotic Additive Manufacturing of Support-Free Parts Using Non-Planar Slicing Algorithm and Five-Axis Print Path"

Christian Rust | Southeastern Louisiana University (SELU) | Space Grant - REA | Poster # 39
Presenting Team Members: Christian Rust; Evan Simon

NASA has been actively evaluating additive manufacturing (AM) technologies for off-earth manufacturing purposes. While the ongoing projects provide valuable insight into the capabilities of AM through technology demonstrations, it is also important to note that the equipment, devices, and materials need to be transported to the end use location, be it International Space Station (ISS) or off-earth locations (e.g., Moon, Mars etc.). Therefore, it is important to maximize equipment utilization and minimize launch payload for such technologies. The current 3D printers are restricted to planar movement for material extrusion which results in slower cycle times due to the

need for support materials when printing complex geometries. These support materials need to be removed before the printed object can be used as an end use part. However, it is not practical to bring large amounts of support material due to payload space and weight limitations. For future use case scenarios, printing capabilities will have to be enhanced through implementation of non-planar 3D printing for maximizing equipment utilization and minimizing wait times. This can potentially be demonstrated using a robotic additive manufacturing system which integrates a 6-axis robot with a material extruder as the end effector. In this proposed research project, the researchers will design and construct a robotic additive manufacturing system, develop slicing algorithms for generating non-planar print paths, 3D print support-free complex parts leveraging on five degrees-of-freedom print paths, and compare non-planar and planar slicing in terms of dimensional accuracy and surface quality.

"Precision Assembly of Space Structures Through Input Shaping-Based Vibration Control"
Darren Johnson | Louisiana State University and A&M College (LSU) | Space Grant - REA | Poster # 40
Presenting Team Members: Darren Johnson, BS Mechanical Engineering; Yousuf Atteia, BS Mechanical Engineering; Carter Burdette, BS Mechanical Engineering

This project will develop input shaping to reduce vibrations during TriTruss alignment and joint insertion for NASA's Precision Assembled Space Structures (PASS) project. Testing will use LSU's FANUC robot and scaled TriTruss testbed in collaboration with NASA Langley. The approach preserves existing controllers while improving alignment and fastening, advancing in-space assembly and providing hands-on student training.

"Generating eight-day Photosynthetic Capacity Product from PACE Hyperspectral Observations"
Chi Qiu | Louisiana State University Agricultural Center (LSU-Ag) | Space Grant - REA | Poster # 41
Presenting Team Members: Chi Qiu, Dr. Peng Fu. Plant, Environmental and Soil Sciences.

The maximum rate of Rubisco carboxylation normalized to 25°C (Vcmax25) is a key determinant of leaf photosynthetic capacity, yet its seasonal variability remains poorly represented in terrestrial biosphere models (TBMs). Assigning fixed values by plant functional type (PFT) overlooks physiological responses to changing environmental conditions and introduces uncertainty into carbon cycle simulations. Spaceborne hyperspectral observations offer an opportunity to characterize these variations through spectral information associated with vegetation biochemical traits. In this study, eight-day global Vcmax25 product retrieved from PACE OCI hyperspectral reflectance will be presented for the 2024-2025 growing seasons. Tower-based reference estimates are derived using a two-leaf light response curve (LRC) framework. Leaf area index (LAI), clumping index (CI), solar geometry, and incoming radiation are used to partition canopy light absorption between sunlit and shaded leaves. Seasonal light-use efficiency and daily light-saturated photosynthetic capacity are estimated from eddy covariance gross primary productivity. The resulting sunlit-leaf photosynthesis is then used to invert Vcmax under high light conditions. Retrieved values are normalized to 25°C to obtain Vcmax25. Partial least squares regression (PLSR) will be used to link tower-derived Vcmax25 with PACE OCI reflectance and upscale to global mapping. Evaluation will use withheld tower sites to assess transferability across PFTs, complemented by comparisons with independent productivity datasets. By combining flux-based constraints with spaceborne hyperspectral measurements, this work provides the first global dynamic Vcmax25 product from spaceborne hyperspectral observations and demonstrates the capability to capture

"Modeling and Analysis of Additive Friction Stir Deposition of Lunar Regolith-Integrated Aluminum Alloy"

Md Ashfaq Siddiquee | Louisiana Tech University (LaTech) | Space Grant - REA | Poster # 42
Presenting Team Members: Md Ashfaq Siddiquee, PhD in Engineering, Concentration: Micro and Nanoscale Systems

Additive Friction Stir Deposition (AFSD) is gaining attention as a solid-state manufacturing technique for fabricating and repairing metallic components. It minimizes many defects associated with fusion-based additive manufacturing. For aluminum alloys, AFSD offers reduced thermal exposure, refined microstructures, and lower porosity and distortion. These characteristics make the process attractive for space manufacturing, where reliability and efficient resource utilization are critical. This study investigates the thermo-mechanical behavior of regolith-reinforced Al 6061 composite deposition during AFSD using a Coupled Eulerian-Lagrangian (CEL) finite element model. Three regolith contents, 0% and 10%, are considered to evaluate the influence of reinforcement concentration on deposition behavior. The simulation examines temperature evolution, material flow, strain localization, and interactions between the aluminum matrix and rigid regolith particles. It is hypothesized that regolith addition will reduce thermal conductivity, increase heat retention and peak temperature, and enhance mechanical strength and flow stress while reducing ductility. The increased flow stress may restrict lateral material flow and reduce flash formation, although thermal softening may partially counteract these effects. Regolith reinforcement is also expected to intensify local stress and strain gradients, potentially improving hardness, stiffness, and wear resistance while excessive reinforcement may promote particle agglomeration and stress concentration. The findings are expected to clarify the process-structure-property relationships governing aluminum-regolith deposition and support the development of resource-efficient materials for terrestrial and in-space applications.

"Leveraging Earth Observation Foundation Models for Characterizing Soil Properties"

Chi Qiu | Louisiana State University Agricultural Center (LSU-Ag) | Space Grant - REA | Poster # 43
Presenting Team Members: Chi Qiu; Dr. Peng Fu; Plant, Environmental and Soil Science

This study evaluated AlphaEarth Foundations (AEF) embeddings for digital soil mapping of soil organic carbon (SOC), focusing on prediction, spatial transferability, and uncertainty quantification. Using approximately 25,800 SOC samples, we compared AEF-only models with a conventional remote sensing and environmental predictor stack. AEF embeddings produced competitive predictions but showed a consistent 20-25% R^2 gap relative to the full predictor set. Adding 14 selected CHELSA climate variables closed about 95% of this gap. Spatial analyses indicated that AEF embeddings capture both geographic and environmental structure, while leave-region-out tests showed better transfer when target regions were more similar in embedding space. AEF-based conformal prediction also improved uncertainty estimates in most cases. Overall, AEF provides a compact and useful representation for soil mapping, but additional climate information remains important for robust prediction and transferability.

"Experimental and Kinetic Modeling Study of Oxy-combustion of C1-C4 Hydrocarbon Fuels: Application

towards space propulsion"

Andre' Pinell | University of Louisiana at Lafayette (ULL) | Space Grant - REA | Poster # 44
Presenting Team Members: Andre' Pinell, Mechanical Engineering; Jackson Morris, Mechanical Engineering

Oxy-methane combustion is the combustion of methane in a pure oxygen environment, unlike regular air used in natural gas turbines. The space market is becoming increasingly competitive, and reusable launchers are envisioned as key technology to reduce the costs of access to orbit. Methane has been identified as the best fuel for developing low-cost reusable space launch systems (high energy density, low operating cost, and good overall performance in specific impulse). Furthermore, oxy-fuel combustion in spark ignition engines enables clean electricity and heat generation in decentralized power plants. Consequently, several methane-based projects are currently being studied and developed worldwide, making understanding pure methane/oxygen combustion (flame dynamics, kinetics, etc.) at high pressure and temperature a key challenge. The available kinetic model for methane/air fails when confronted with methane/oxygen experimental data available in literature. The idea of oxy-methane combustion is relatively new, and the successful use of this technology could revolutionize the next-generation space and power generation industries. The same very idea can be expanded to higher hydrocarbon fuels like ethane, propane, and butane, which are also the composition of natural gas.In this project, we propose developing the heat flux burner setup to investigate the laminar flame speed of methane, ethane, propane, and butane in an oxygenrich environment. In the experimental campaign, we will measure the laminar flame speed in a wide range of conditions. The experimental data will be utilized to develop the chemical kinetic model, which can be used for the 3D simulations and predictions of various flame characteristics.

"Louisiana State Rocket"

Yui Hatsuyuki | Louisiana State University and A&M College (LSU) | Space Grant - SAFOS | Poster # 45
Presenting Team Members: Yui Hatsuyuki; Michael Fraser; Kevin Guo

Brief overview and summary of LSU's competitive rocketry team and our activities such as researching, designing, and manufacturing high power rockets and adjacent systems.

"Modeling and Validating Heat Generation Mechanisms in Ultrasonic Welding of Thermoplastic Composites"

Felipe Savella | Louisiana State University and A&M College (LSU) | NASA EPSCoR - Basic Research | Poster # 46
Presenting Team Members: Felipe Savella, Engineering Science

This study investigates heat generation mechanisms during ultrasonic welding (USW) of thermoplastic composites (TPCs), focusing on surface friction and viscoelastic dissipation. Experimental trials were conducted using glass fiber/polypropylene (GF/PP) and carbon fiber/polyetheretherketone (CF/PEEK) with pure polymer interlayer films under a 1000 N force, 38.1 μm vibration amplitude, and welding durations from 75 ms to 1000 ms. Interfacial temperature profiles were monitored using thermocouples and compared against two COMSOL Multiphysics simulation approaches. Model 1 utilized a 2D geometry accounting solely for viscoelastic heating via the melting heat equation, neglecting surface friction. Model 2 implemented a 3D multiphysics framework combining solid mechanics and heat transfer to capture both Coulomb surface friction and viscoelastic dissipation. The results

show that Model 1 reasonably predicted mid-interface thermal trends (305°C simulated vs. 328°C experimental). However, Model 2 more accurately captured the rapid initial heating and localized melting originating at the overlap edges (reaching 345°C), closely matching experimental observations. Overall, Model 1 is effective for rapid mid-interface temperature estimations, while Model 2 is essential for detailed spatial analyses, edge phenomena, and assessing the effects of misalignment or defects.

"Experimental Investigation of Degree of Healing Between Dissimilar Thermoplastic Materials for Ultrasonic Welding"

Md Masud Rana | Louisiana State University and A&M College (LSU) | NASA EPSCoR – Basic Research | Poster # 47

Presenting Team Members: Md Masud Rana, Mechanical Engineering

Ultrasonic welding (USW) is an attractive joining technique for thermoplastic composites (TPCs) due to its short processing time and suitability for automation, assembly, and reassembly applications. A fundamental mechanism governing weld formation in thermoplastics is polymer chain diffusion across the joint interface, which can be quantified through the degree of healing (DOH). Understanding how healing varies between similar and dissimilar thermoplastic materials is essential for tailoring the welding process, joint design and strength, and reusability. This study presents an experimental investigation of the DOH between thermoplastic materials relevant to aerospace applications. Polyether-etherketone (PEEK) was evaluated in combination with several interfacial materials: polyetherimide (PEI), polyphenylene sulfide (PPS), and low-melt poly-aryletherketone (LM-PAEK). DOH measurements were conducted using a parallel plate rheometer with 25 mm thermoplastic disks separated by perforated polyimide films to localize bonding. Samples were subjected to controlled thermal cycles between 300 and 380 °C, constant compressive force (30 N), and con-tact times relevant for the USW process (1, 5, 10, and 60 s). The DOH was calculated as the ratio of interfacial stress to the maximum achievable stress. Based on the experimental results, interfacial healing strongly depended on temperature, contact time, and polymer compatibility. PEEK/PEI exhibited the strongest healing response among the dissimilar systems, while PEEK/PEEK also showed good healing due to self-diffusion. PEEK/LM-PAEK showed intermediate healing that improved at higher temperature, whereas PEEK/PPS showed the weakest bonding response. These results provide guidance for selecting interfacial materials and processing conditions for USW of dissimilar TPC structures.

"Generating Functionally Mature hiPSC Motor Neurons for Space Environment Simulation Research"

Joshua Rychart | Louisiana Tech University (LaTech) | NASA EPSCoR - Basic Research | Poster # 48

Presenting Team Members: Joshua Rychart, Molecular Science and Nanotechnology

Introduction: The inaccessibility of patient brain for routine study is a blatant issue in the field of neuroscience. The ability to study human motor neurons (MNs) opens the door to more precise treatment for neurological diseases such as amyotrophic lateral sclerosis and spinal muscular atrophy.

Aims: This study is supported by NASA(2026)-RAP-67 grant to M.S. and aims to generate high yield, pure and mature human MNs from human induced pluripotent stem cells (hiPSCs) using a lentiviral vector for subsequent studies of neurodegenerative disease mechanisms and therapeutic strategies.

Methods: A novel protocol is developed for astrocyte extraction from brains of mice pups. Purifying plasmids from a bacterial culture is currently processing. The remaining steps that will be performed are lentivirus preparation, differentiation of hiPSCs to neuronal progenitor cells (NPCs), lentiviral transfection of NPCs to differentiate to MNs, and morphology and transcriptomic evaluations.

Results: Astrocytes are confirmed by morphology and GFAP expression through immunofluorescent evaluation. We expect to make a good third generation lentivirus and then creation of pure and mature MNs that will be identical in structure to naturally obtained mature human MNs. We expect the gene expression shown from transcriptomic evaluation to be identical as well and show MN switch pattern.

Conclusion: This model can provide a way to assess, develop, and analyze potential methods for the treatment of neurological diseases that affect MNs as well as serve as the first step to developing more complex models such as neuromuscular junction and organoids.

Key words: Motor neurons, astrocyte, coculture, neurotoxicity model, transcriptomics.

"Bright lanthanide and transition metal coordination complexes for NASA missions"

Lily Townsend | Louisiana Tech University (LaTech) | Senior Design | Poster # 49
Presenting Team Members: Lily Townsend, Chemistry; John Sibley, Chemistry/Physics; Hannah Huckabay, Chemistry; Quincy Franklin, Chemistry; Ethan McGee, Chemistry

NASA missions require bright materials for general lighting, sensors, scintillators, and therapeutic purposes. Our research has focused on lanthanide complexes including europium and terbium, which are bright red and green emitters respectively. However, we can synthesize complexes with a wider variety of colors if we also include transition metals such as copper(I). Our ligand library includes highly conjugated N-donor ligands including phenanthroline, terpyridines, and SALEN. Because of our extensive ligand library and variety of potential metals, we are using a multi-prong approach to synthesizing highly emissive complexes in an environmentally friendly and reproducible manner. The project will be broken down into ligand synthesis including the use of Sonogashira and Suzuki coupling, mechanochemical synthesis of lanthanide coordination complexes, the mechanochemical synthesis of Cu(I) complexes, and solution investigations of the binding properties of these ligands. In order to characterize the complexes, in the solid-state, IR spectroscopy, Raman, single crystal X-ray diffraction, powder X-ray diffraction, and X-ray photoelectron spectroscopy will be used. The solution behavior of these complexes will also be investigated using 1H and 13C NMR, UV-Vis, and fluorimetry. Using this approach, we will find suitable, soluble, highly emissive complexes that can be doped into polymers such as PMMA, PVT, and epoxy resins.

"Dimensional accuracy of additively manufactured parts"

Joseph Robinson | Southeastern Louisiana University (SELU) | Space Grant - Senior Design | Poster # 50
Presenting Team Members: Joseph Robinson Mechanical Engineering

The objective of NASA's In-Space Manufacturing initiative is to develop the technologies and processes which will enable on-demand manufacturing capability during long-duration space missions. Accordingly, NASA has been actively evaluating additive manufacturing (AM) technologies for off-earth manufacturing purposes. While the ongoing projects are providing valuable insights on capabilities of AM through technology demonstrations, it is also

important to note that the dimensional accuracy of the printed parts play a crucial role when it comes to putting the parts together to form an assembly or installing a part in an existing system as a spare part. The current software and hardware implementation of 3D printing workflow results in parts that deviate from the computer-aided design (CAD) model within a certain range. This is caused by the slicing profiles implemented in the software and the type of hardware configuration used for the printer. To address this issue, a temporary workaround is to use a rule of thumb clearance between all mating joints, resulting in a workflow that requires additional trial and error prints for verification. Such workflow is not ideal for in-space manufacturing where time and resources are limited. In this proposed senior design research project, the students will identify benchmark parts, 3D print and 3D scan the benchmark parts, compare the scans with the CAD model for deviations in dimensions, and identify the effects of slicing profiles and hardware configurations on dimensional accuracy.

"Simultaneous improvement of tensile properties and surface finish of additively manufactured parts"

Aaron Christiansen | Southeastern Louisiana University (SELU) | Space Grant - Senior Design | Poster # 51
Presenting Team Members: Daquana Miller, Mechanical Engineering Technology; Aaron Christiansen, Mechanical Engineering Technology

The objective of NASA's In-Space Manufacturing initiative is to develop the technologies and processes which will enable on-demand manufacturing capability during long-duration space missions. Accordingly, NASA has been actively evaluating additive manufacturing (AM, also known as 3D printing) technologies for off-earth manufacturing purposes. While the ongoing projects are providing valuable insights on capabilities of AM through technology demonstrations, it is also important to note that part quality and surface finish are crucial for end use applications (e.g., load bearing, part assembly). Material extrusion additive manufacturing involves laying up layers of molten plastic using an extrusion nozzle to build the 3D printed part. The nozzle diameter affects tensile properties of the printed part. Larger nozzle diameter results in better tensile properties (shorter print times) but with poor surface finish whereas small nozzle diameter results in smooth surfaces (longer print times) but with poor tensile properties. Thus, a trade-off is made to either have better surface finish at the expense of poor tensile properties or vice versa. This project aims to solve this problem through strategic use of different diameter nozzles. In this proposed senior design research project, the students will (1) identify appropriate print configuration to utilize independent dual extrusion, (2) design experiments to identify the effect of varied wall and infill layer heights on tensile and surface finish properties, and (3) determine tensile and surface finish properties using universal testing machine and 3D surface profiling, respectively, to identify process-structure-property relationships.

"Design and Implementation of an Autonomous Solar Tracking System"

Joshua France | McNeese State University (McNeese) | Space Grant - Senior Design | Poster # 52
Presenting Team Members: Joshua France, Electrical Engineer

Traditional static or timer-based solar installations suffer from reduced efficiency due to seasonal shifts and unoptimized orientation relative to the sun's position. To address these limitations, a multidisciplinary engineering team at McNeese State University developed a fully autonomous, closed-loop, dual-axis solar tracking system designed to optimize energy capture while incorporating remote monitoring and multi-layer circuit protection.

The system integrates four solar panels, a dual-battery storage setup, Maximum Power Point Tracking (MPPT), linear actuators, and Light Dependent Resistors (LDRs) fitted with custom 3D-printed baffles to minimize stray-light interference. Dual Arduino Nano ESP32 microcontrollers were selected for sensor processing and control logic, utilizing ESP-NOW wireless protocols and deadband algorithms to control panel alignment and prevent excessive micro-adjustments. A custom Printed Circuit Board (PCB) was designed in Altium Designer to streamline internal wiring, isolate analog and digital signals, and enable modular component replacement. Safety features include circuit breakers, fuses, optocouplers, and a wind-speed protection routine that flattens panels during dangerous gusts. Environmental and performance metrics-voltage, current, power output, temperature, humidity, and wind speed-are displayed on a local LCD screen and transmitted via Wi-Fi to a Blynk IoT cloud platform for real-time monitoring and data logging.

"Digital twin, traffic-signal recognition, synthetic-to-real learning, spatiotemporal , YOLO, ResNet-18, GRU, Unreal Engine."

Collins Adu Addo | Louisiana State University and A&M College (LSU) | other | Poster # 53
Presenting Team Members: Collins Adu Addo,Electrical Engineering

Training robust traffic-signal recognition systems requires large annotated datasets that capture diverse environmental and operational conditions, yet acquiring such data is expensive and time-consuming.This paper proposes a digital-twin-based spatiotemporal framework for synthetic-to-real traffic-signal recognition. A high-fidelity digital twin of a real-world signalized intersection is developed in Unreal Engine to generate continuous traffic-signal sequences with automatic spatial and state annotations under diverse environmental conditions. The proposed framework integrates traffic-signal detection, structure-aware spatial encoding, and temporal sequence modeling for traffic-signal-state recognition. The framework is trained entirely on synthetic data and evaluated on real-world traffic scenes without real-image fine-tuning. Experimental results demonstrate that the framework achieves a state-recognition accuracy of 99.05\%. These results demonstrate the potential of digital-twin-generated synthetic data for real-world traffic-signal recognition.

"Student Engagement in Space Activities at Xavier(SESAX)"

Christopher Adams | Xavier University of Louisiana (Xavier) | Space Grant - STEMS | Poster # 54
Presenting Team Members: Tina Nguyen Chemical Engineering; Danijah Mariah Durio Mechanical Engineering

This is an undergraduate student program for students at Xavier. The purpose of the program is to give students experience with working in space-related fields. We are learning relevant skills in such areas as electronics, programming, and project management. Part of the program is to design, build and test a payload to be flown on a NASA research balloon. The program also allows participating students to attend talks given by aerospace professionals and to visit regional NASA centers.

"Extracting Bioactive Compounds from Coffee Silverskins"

Reagan Tapie | Louisiana Tech University (LaTech) | LURA | Poster # 55
Presenting Team Members: Reagan Tapie, Chemical Engineering

In this project, I am working to extract bioactive compounds from coffee silver skins using water in a closed loop process. I do this by using vacuum filtration and DCMD to pull the desired compounds out of the coffee chaff and then separate them from the water. This is a process that will utilize the compounds left in coffee waste while not wasting any water because the water is separated from the compounds and is reusable again. This presentation will show early findings on this year-long project, showing the initial steps I complete in the first few months of the project.

"Optimal Periodic Trajectory Generation for Long-Range Autonomous Cargo Delivery Using Fixed-Wing UAVs"
Don Nguyen | Louisiana State University and A&M College (LSU) | Space Grant - LURA | Poster # 56
Presenting Team Members: Don Nguyen, Electrical Engineering

This project will optimize periodic climb-and-glide trajectories for fixed-wing UAV cargo delivery to improve endurance, range, and energy efficiency. An undergraduate student will model and optimize flight paths, compare them with conventional strategies, and validate performance through Flightory Stallion flight tests. The work supports NASA's Advanced Air Mobility priorities and provides training in optimal control and autonomous flight.

"Learning-Based Model Predictive Control for Autonomous Quadcopter Navigation via EDMD-c"
Peyton Bell | Louisiana State University and A&M College (LSU) | Space Grant - LURA | Poster # 57
Presenting Team Members: Peyton Bell, Mechanical Engineering; Sanjay Maharjan, Mechanical Engineering PhD

This project will experimentally validate a learning-based quadcopter controller combining EDMD-c and Model Predictive Control. An undergraduate student will implement the controller on a Pixhawk-equipped UAV, integrate sensors, and evaluate waypoint tracking and disturbance robustness through flight tests in Baton Rouge. A NASA Langley research visit will complement hands-on training in autonomous flight, supporting NASA's intelligent flight control priorities.

"Design and Implementation of a Controlled Fuel Preheating Module for High-Speed Propulsion Applications"
Marc St Martin | Louisiana State University and A&M College (LSU) | Space Grant - LURA | Poster # 58
Presenting Team Members: Marc St Martin, Mechanical Engineering

Under NASA's High-Speed Flight (HSF) project, which works on commercial flight technology ranging from Mach 1 to Mach 5, we see thermal management presenting a severe engineering problem. These thermal loads cannot be simply managed using traditional engine bypass air cooling alone. By using jet fuel as an onboard heat sink, we can help dissipate some of the thermal energy within the system. However, high-temperature fuel introduces

knowledge gaps on the stability and performance when combusted. Currently, our project is in the design and fabrication phase, where we are focused on selecting and developing hardware for our project. Our goal is to design, install, and validate a controlled fuel heating module that is capable of delivering Jet-A fuel at repeatable, stable temperatures. Our current design utilizes a temperature PID controller that regulates voltage to heating elements surrounding our fuel line. A downstream thermocouple will monitor the temperature and provide feedback to our PID controller to regulate the temperature. Once finalized, we will be able to compare combustor performance at baseline conditions versus various elevated preheated temperatures. Specifically we will be focused on how increased fuel temperatures affect spray atomization, fuel evaporation, and combustion stability such as LBO (Lean blowout) limits.

"Battery Degradation Modeling and Lifetime Assessment for Lunar Energy Storage Systems in Harsh Lunar Environments"

Blake Langley | McNeese State University (McNeese) | Space Grant - LURA | Poster # 59
Presenting Team Members: Blake Langley, Engineering, Electrical Engineering Concentration

This project evaluates an existing neural network-based battery degradation model under simulated lunar environmental conditions, supporting NASA's Artemis Program and Lunar Surface Innovation Initiative (LSII). As battery energy storage systems are essential for future lunar surface operations, understanding battery degradation under extreme temperature variations, vacuum conditions, and radiation exposure is critical. Rather than developing a new model, the project applies a machine learning-based degradation framework developed at McNeese State University's Power and Microgrid Lab and incorporates lunar-specific operating profiles into the simulation environment. Over a 9.5-month period, the student will gain hands-on experience in battery modeling, machine learning, and space energy systems. The research will examine the degradation behavior of lithium-ion battery chemistries, including NMC and LFP, evaluate model prediction accuracy, and compare performance under lunar and terrestrial conditions. The student will prepare a technical report and research poster, with opportunities to present findings at undergraduate research conferences. This project provides interdisciplinary training in simulation, data analysis, and scientific communication, preparing the student for advanced study and careers in aerospace and energy technologies.

"Predictive Safety Modeling of Reactive Particles in Space Manufacturing and In-Situ Resource Utilization"

Isabelle Lieux | Louisiana Tech University (LaTech) | Space Grant - LURA | Poster # 60
Presenting Team Members: Isabelle Lieux

Space manufacturing and in-situ resource utilization (ISRU) are enabling technologies for sustained human exploration of the Moon, Mars, and beyond. Many proposed ISRU and manufacturing processes involve the handling, transport, storage, and processing of fine reactive particles, including lunar regolith, metal powders, catalyst materials, and particulate byproducts. Under certain conditions, these materials may present safety risks such as ignition, rapid oxidation, thermal runaway, dust explosions, and electrostatic discharge, which can compromise mission reliability and crew safety. However, the unique environments encountered in space-including reduced gravity, low-pressure atmospheres, confined habitats, and elevated oxygen concentrations-

significantly alter particle behavior and hazard mechanisms, making terrestrial safety guidelines insufficient. This project aims to develop a predictive safety modeling framework for reactive particulate systems relevant to space manufacturing and ISRU. Multiscale models will be developed to describe particle-scale heat and mass transfer, reaction kinetics, ignition phenomena, and dust cloud dynamics under space-relevant conditions. The framework will integrate fundamental transport processes with hazard analysis tools to identify critical operating conditions that may lead to unsafe events. Model predictions will be used to evaluate representative ISRU scenarios, such as regolith processing, oxygen extraction, additive manufacturing, and particulate material handling. The proposed work will provide science-based guidance for hazard prediction, risk mitigation, and safety-by-design strategies, supporting the development of reliable and resilient space manufacturing systems for future exploration missions.

"Synthesis and Structural Characterization of Novel Supertetrahedral-based Indium Pnictide Zintl Phases"

George Tisdale | Louisiana State University and A&M College (LSU) | Space Grant - LURA | Poster # 61
Presenting Team Members: George Tisdale, Senior

Supertetrahedral structures are one mesoscopic motif that is relevant to design of thermoelectric and/or semiconductor materials. Herein we report the syntheses of the novel solid-state compounds Ba36In51Pn75, Ba3In6Pn8, and Ba33In38Pn60 (Pn = P, As). The high-temperature, flux reactions were performed at 1000 K in alumina crucibles and cooled slowly to 800 K before the furnace was turned off, aside from Ba36In51As75 being cooled slowly before centrifugation at 650 K. Ba36In51As75 consists of Ba2+ cations between [In20As35]45- (T4) and [In35As56]63- (T5) supertetrahedra which share common InAs4 corners, crystallizes in the I4(1)/a space group (a, b = 21.2486(6) Å, c = 42.6834(18) Å), and contrasts known layered structures possessing solely T5 or T6 supertetrahedra. This novel assembly of InAs, itself a direct band gap semiconductor, is structurally analyzed and compared with its counterparts, representing rare supertetrahedra that do not require binary vacancies or mixed-metal strategies. Simultaneously discussed are discovered barium, and barium phosphide, analogs of Ba3In6As8, of the T6 structure type (C2/c), as well as the first T4 InAs supertetrahedral structure in the C2/c family that may contribute to the delineation of a supertetrahedral homologous series. By extending the novel structures to their strontium, gallium, and phosphide analogs, gathering optical band gap, resistivity, and Hall-effect measurements, and performing electronic structure calculations, this series of compounds wil provide insights into the design of thermoelectric materials and alternate assemblies of direct band gap semiconductors.